MARCH, 1961

Plant Engineering®

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The magazine that helps plant engineers with their everyday problems

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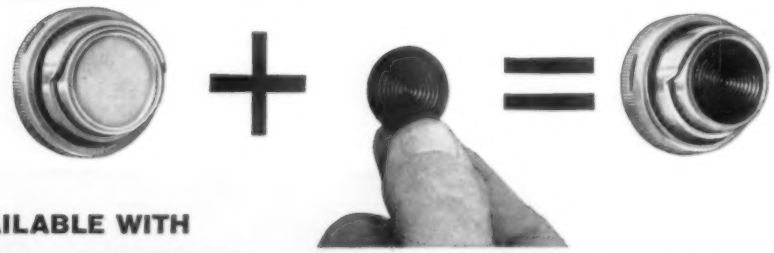

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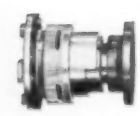
Reduce your inventory • Order push buttons in color desired, or get the new "universal" package containing a basic operator and seven different color inserts—no extra cost. Inserts just snap in, can be changed in seconds if necessary.

7 colors available • Choose from black, red, green, brown, yellow, orange, blue.

Complete flexibility • Any operator can be used with any contact block to meet every requirement. Contact block arrangements include single-pole double-throw, two-pole double-throw, four-pole double-throw, sequence closing, and overlapping contacts.

A COMPLETE LINE OF OIL-TIGHT OPERATORS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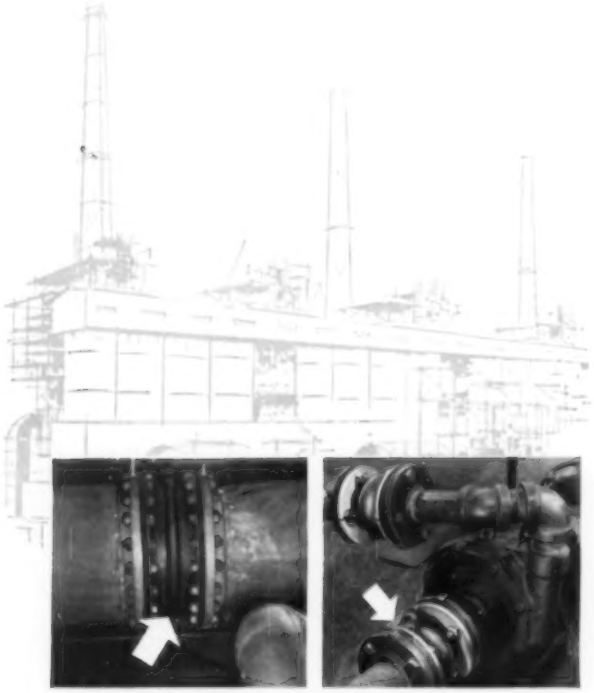
ENGINEERED PRODUCTS

for Plant Maintenance



Typical installations show Garlock Rubber Expansion Joints on a 26" vacuum condenser inlet (left) and 2½" suction and discharge pipes. Garlock furnishes standard joints from ¾" to 72" in pipe diameter, and in all shapes.

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2. Eliminate vibration and noise. Pumps, compressors, engines, and pressure surges in pipe lines create vibration and objectionable noises. Garlock Rubber Expansion Joints act as an absorbent cushion . . . reduce vibration and insulate against transfer of noise to other parts of the building.

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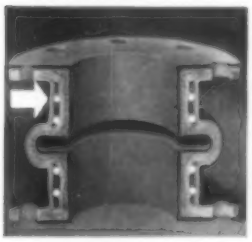
4. Reduce flange breakage. Undue stress caused by misalignment, vibration, expansion or contraction of piping or equipment, will break the metal connecting flanges. Garlock Rubber Expansion Joints relieve such stresses.

Offer many application advantages. Garlock Rubber Expansion Joints outlive metal ones; do not crack, corrode, lose shape, or require gaskets. The sturdy construction of Garlock Rubber Expansion Joints results in satisfactory service where pressures are as high as 150 p.s.i., temperatures to 180°F.



Expansion joints are also available for service up to 450°F. In the photo of the joint cut in half, the arrow points to a steel reinforcing ring which, when varied in number with the joint size, provides the extra strength needed for the most severe applications.

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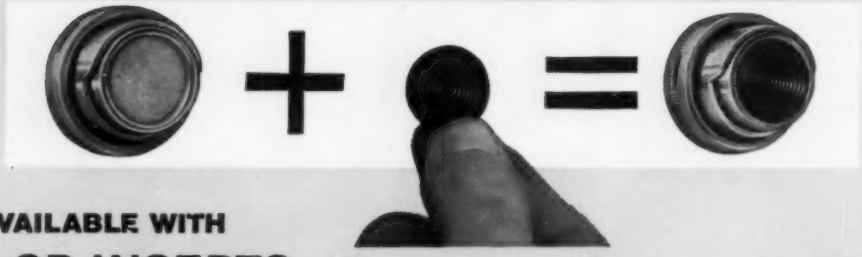

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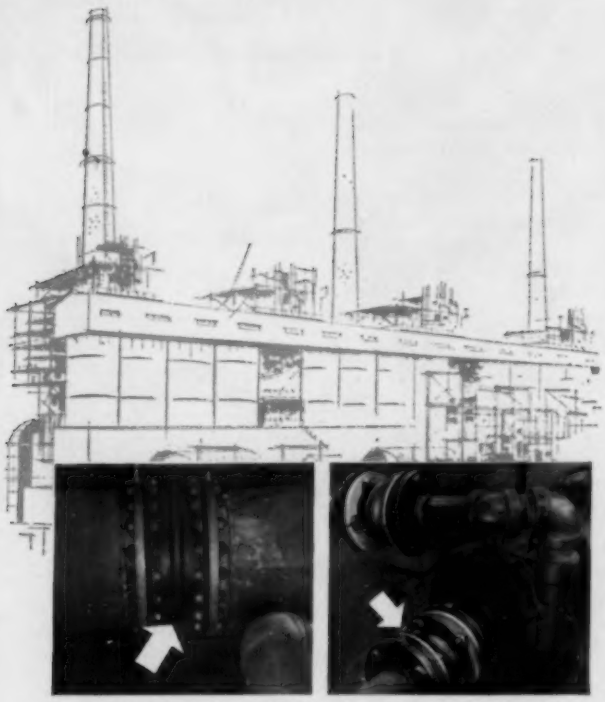

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TURN SCRAP HANDLING INTO A PROFIT!

Segregated scrap brings higher prices. Add the convenience of easier collection and easier handling, and in most cases you can convert scrap handling from a loss to a profit.

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RIGHTS ITSELF

LOCKS ITSELF

Hundreds of industries now use Roura Hoppers to collect scrap metal. They're placed alongside machines or in strategic locations. When full, a lift truck picks up the loaded hopper . . . transports it to scrap bin or freight car . . . flips the latch . . . and the hopper *automatically* dumps itself, rights itself, locks itself.

Roura Hoppers are made in eight standard sizes . . . in ½ to 4 yard capacities. Ruggedly built of 3/16" steel plate with continuous arc-welded seams, the hoppers give years of continuous service. Heavier plate, stainless, aluminum or galvanized is also available if desired. Standard models shipped from stock.

Specifications are available without obligation. Phone us collect at Townsend 8-3560 or use the handy coupon.

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WANT MORE DETAILS? Just clip this coupon to your letterhead, sign your name and mail to:

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'ROUND ABOUT

training session for foremen. The leader's manual tells how to set up meetings and apply the material to individual plant situations.

The course offers practical instructions on ways a foreman can better understand his men and work with them toward safer, more efficient work practices.

Further information about "Men and Motives" is available from the National Safety Council, 425 N. Michigan Ave., Chicago 11, Illinois.

Industrial Mutual Aid and Disaster Control Seminar

THE FIFTH ANNUAL Industrial Mutual Aid and Disaster Control Seminar will be held from April 18 through the 20 at the Shamrock-Hilton Hotel, Houston, Texas. The seminar is sponsored by the National Institute for Disaster Mobilization.

Here is a brief review of the workshop sessions being planned for this conference: In-Plant Disaster Control, Industrial Medical Services in Disasters, Radiation Hazards, and Industrial Mutual Aid Operations in Natural Disasters.

For further seminar or registration information, contact S. A. Anthony, Jr., The National Institute for Disaster Mobilization, Inc., 475 Fifth Ave., New York 17, N. Y.

New Appointments at Youngstown

NEW SUPERINTENDENTS of maintenance have been named for both the Campbell and Brier Hill plants of The Youngstown Sheet and Tube Company, Youngstown, Ohio.

Bernie P. Askew has been assigned to the post at the Campbell Works, succeeding William T. Morris, retired. He has been an assistant superintendent since 1948.

Paul F. Schmidt, with the company since 1934, will be head of the maintenance department at the Brier Hill Works. He previously was maintenance foreman at Youngstown's rod and wire mill at the Struthers plant.

Plastics in Buildings

PRESENT and future uses of plastics in building construction will be discussed at the one-day conference on April 20, 1961, at Springfield, Mass. The conference is sponsored by the Western New England Section of the Society of Plastics Engineers and will be held at the Springfield Museum of Fine Arts.

Technical program will consist of the following subjects: plastics in building exteriors, importance of structural and dimensional stability of plastics materials, resistance to weathering, thermal insulation and plastics in lighting aplications.

For further conference information, write to Robert W. Sherman, Union Carbide Plastics Company, 410 Asylum St., Hartford, Conn.

Lubrication Conference

THIS YEAR'S program of the three-day conference of the American Society of Lubrication Engineers is designed to "have something for everyone." It will be held from April 11 through the 13 at the Bellevue-Stratford Hotel, Philadelphia, Pa.

Here is a subject preview of the three-day sessions: bearing and bearing lubrication, lubrication of seals and packings, properties of lubricants, fluids for metal working, machine tool lubrication. In addition, general sessions will cover lubricant disposal, rust preventives, radiation resistant greases, fire resistant turbine fluids, and marine hydraulic applications.

For more information about this conference, address your inquiry to the American Society of Lubrication Engineers, 5 North Wabash Ave., Chicago 2, Illinois.

Editorial Position – Electrical Engineering Background

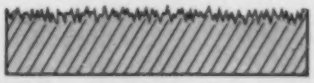
Once again PLANT ENGINEERING'S Editorial Department must look to the future and we are seeking another plant electrical engineer who is interested in becoming an editor. The man we need should be a graduate engineer with at least 5 years' experience in industrial plant electronics, instrumentation and automated equipment application and design, with first-hand experience in the maintenance of electronic controls, instruments and systems. All inquiries will be kept strictly confidential. Send full particulars to The Editor, PLANT ENGINEERING, 308 East James St., Barrington, Ill., and enclose a photo with a brief resumé of education and industrial experience.

CLIMAX MOLYBDENUM

Molysulfide® News Digest

CLIMAX MOLYBDENUM COMPANY, a division of American Metal Climax, Inc., 1270 Avenue of the Americas, New York 20, N.Y.

MOLYSULFIDE INCREASES TOOL LIFE AS MUCH AS 300 PER CENT



When magnified, a piece of highly polished metal is actually smooth to touch, yet presents a cross-section of saw-tooth irregularity. Molysulfide fills in the valleys, prevents the peaks from tearing, permits plastic deformation of the metal to make a smoother surface.

COMPOUND CONTAINING MOLYSULFIDE REDUCES MACHINERY WEAR-IN TIME

During the wear-in period of machinery, permanent surface damage . . . variously described as *galling, scuffing, scoring, tearing, scratching, excessive abrasion* and *seizing* . . . is an inherent hazard.

After years of experience, leading equipment builders agree that an MoS_2 compound is the best guarantee against wear-in damage. Here are five ways such a compound, applied to moving parts prior to operation, can save you wear-in time, money and possible grief:

1. Shortens wear-in period without use of abrasives.
2. Eliminates stick-slip behavior and resists galling and seizing at bearing pressures far beyond the yield point of any metals.
3. MoS_2 particles have a tenacious adherence to bearing surfaces. Will not scrape off.
4. Need not be burnished into surface. Brush or wipe on a thin coating.
5. Inexpensive in the long run. A little goes a long way.

When writing, refer to CL-103

MoS_2 Provides Greater Resistance to Wear at High Temperatures

The Alpha-Molykote Corporation in Stamford, Conn., is now marketing a new Molysulfide bonded lubricant for ferrous surfaces.

Applied with a conventional paint spray gun, this compound fills the microscopic valleys of the surfaces of tool steel and gives on-the-spot lubrication that allows the chips to glide. Once sprayed, it dries at room temperature to a tough film that has a thickness of 0.0001—0.0008 in. and a coefficient of friction of 0.03 at 100,000 psi.

Extremely resistant to wear at high pressures and temperatures (operating temperature range -300 to 600 F) this new compound requires neither chemical nor mechanical surface pretreatment and, because of its high adherence and low friction coefficient, it increases cutting tool life as much as 300%.

Effectiveness of this lubricant comes mainly from the weak layer-to-layer bonds which allow easy sliding and, within individual layers, from the cohesive forces between Mo and S atoms that are quite strong and prevent penetration by surface asperities.

Minimum coverage coating is 285 sq. ft./lb., and consumption is about 1% of tool weight. Normal lubricating oils, cutting fluids or solvents have no effect on these coatings.

When writing, refer to CL-101

Punch Life Increased from 2,000 to 25,000 Holes in Steel Plate

These punches (11/16") were used to punch 25,000 holes in ½"—1020 cold rolled steel plate. Without a lubricant containing MoS_2, a maximum life of only 2,000 holes could be obtained.

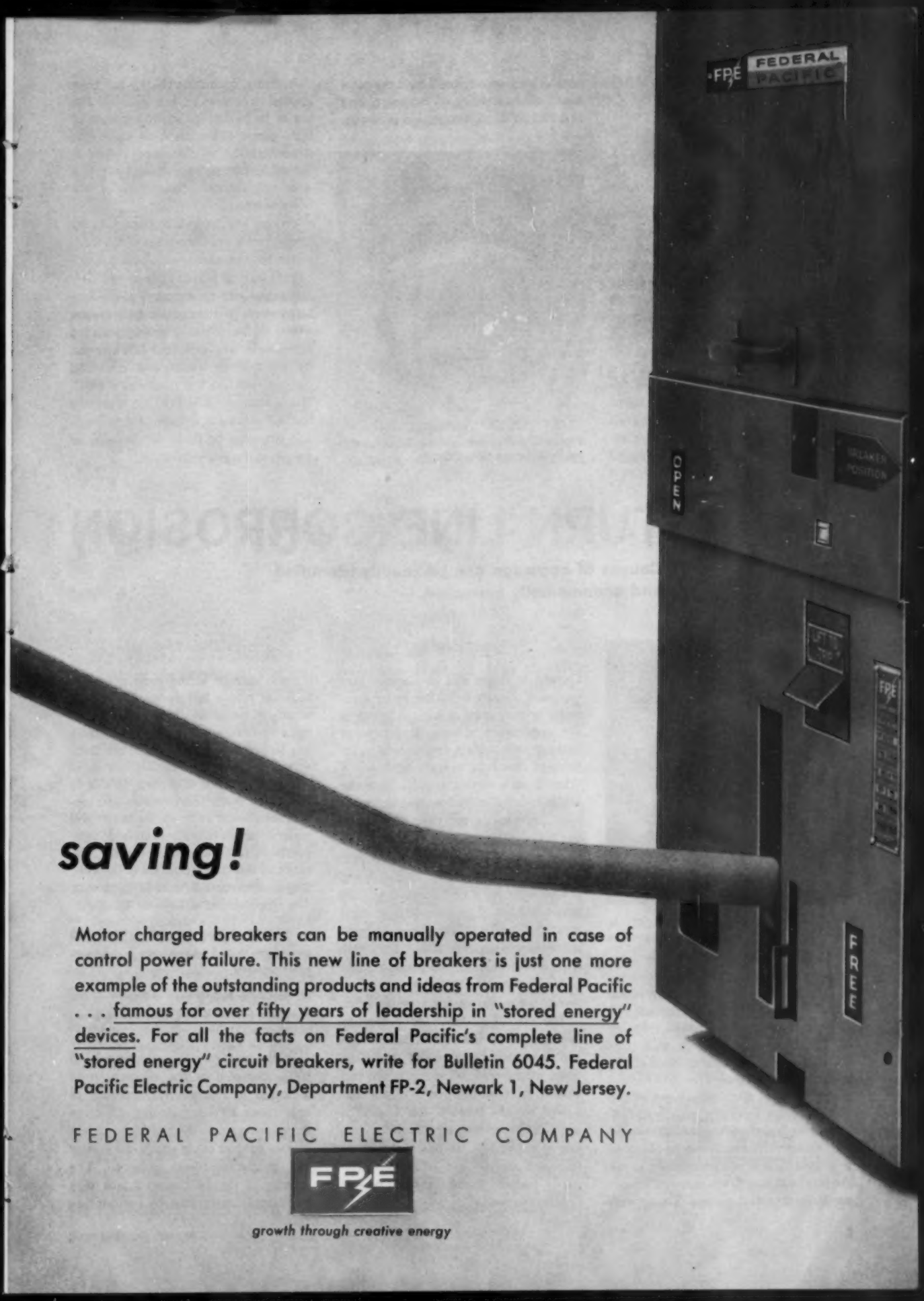
A West Coast manufacturer was experiencing low punch life with the best available lubricants. His multiple punching operation consisted of cold shearing 50 holes simultaneously in a single steel plate. A maximum life of 2,000 holes per punch was obtained with ordinary lubricants.

Then, a compound containing Molysulfide was applied to the punch. The result: punch life was increased from 2,000 to 25,000 holes and, as can well be imagined, considerable savings were effected.

When writing, refer to CL-102

the handle to a $5200

Just one stroke of the handle stores the closing energy in the new and unique Federal Pacific 5 KV and 15 KV circuit breakers. By eliminating outside power sources, the new breakers cut installation costs up to $5200 on battery, cable and control requirements alone. And "stored energy" is *safe* energy with Federal Pacific breakers . . . even for inexperienced operators! Our exclusive foolproof interlock prevents actuation unless instrument door is *closed and locked.* Also available . . . electric motor charged "stored energy" breakers . . . for new economy and reliability in unattended installations.



saving!

Motor charged breakers can be manually operated in case of control power failure. This new line of breakers is just one more example of the outstanding products and ideas from Federal Pacific . . . famous for over fifty years of leadership in "stored energy" devices. For all the facts on Federal Pacific's complete line of "stored energy" circuit breakers, write for Bulletin 6045. Federal Pacific Electric Company, Department FP-2, Newark 1, New Jersey.

FEDERAL PACIFIC ELECTRIC COMPANY

FPE

growth through creative energy

HELPFUL WATER CONDITIONING DATA FROM BETZ

RETURN LINE CORROSION

Causes of corrosion can be readily identified and economically corrected.

Corrosion in the condensate return lines of boiler systems is a frequent problem. To properly prescribe a solution to the difficulty, it is necessary to determine the primary cause of the attack. Prompt elimination of serious return line corrosion is certainly most advisable since necessary maintenance and replacement of pipe and fittings can be quite costly.

By far the most common causes for return line corrosion are the presence of either oxygen or carbon dioxide, or both of these gases dissolved in the condensate. The appearance of the corroded sections will be a good indication of the cause. An attack by carbon dioxide will be characterized by an actual thinning of the metal wall of the pipe, with associated grooving of the metal. Such attack is illustrated in Figure 1.

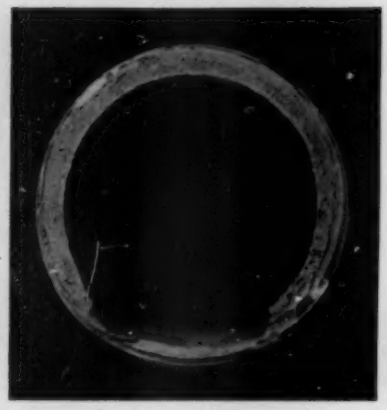


Figure 1—Grooving attack by CO_2 is shown in this end view of the condensate pipe.

Corrosion by dissolved oxygen will be evident by a series of pits, usually accompanied by deposits of the reddish colored iron oxides. Such attack may be observed in Figure 2. It is not uncommon to see the results of attack which is due to both oxygen and carbon dioxide. The appearance of such sections will have the combined characteristics of oxygen pitting and carbon dioxide corrosion grooving.

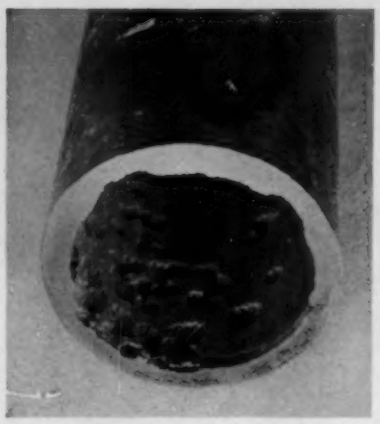


Figure 2—Oxygen pitting attack, distinctly different from CO_2.

Oxygen Attack

Oxygen in steam and condensate may originate directly from the boiler feedwater or may enter at various points in the condensate system. Boiler water makeup will contain appreciable quantities of dissolved oxygen, especially if taken from a surface supply. Since the solubility of dissolved oxygen decreases with increasing temperature, when the feedwater undergoes an increase in temperature in the boiler itself, the dissolved oxygen will be liberated and passed over with the steam. This fact makes the use of an open or deaerating heater of utmost importance in good engineering design of a boiler plant. With such an installation, the major portion of the oxygen in the water will be removed before the water enters the boiler.

The use of an open or deaerating heater removes the oxygen by mechanical deaeration of the boiler feedwater. Since mechanical deaeration is not successful in removing 100% of the dissolved oxygen present, the feed of a chemical deaerant is economically justified to assure that the last traces of the dissolved oxygen are removed. Ordinarily, sodium sulfite (Na_2SO_3) is used for this purpose.

Recently, hydrazine (N_2H_4) has been applied to achieve oxygen removal. The use of hydrazine is usually confined to high pressure installations where the concentration of dissolved solids is critical. Unlike sodium sulfite, hydrazine does not increase the solids of the boiler water.

Oxygen attack can take place not only due to inefficient deaeration of the feedwater, but also through the possibility of oxygen leakage into the condensate. Air infiltration can be expected at condensate pumps, or other points in the system where air may come in contact with the condensate. This potential difficulty can be checked by conducting dissolved oxygen tests on the condensate itself. If it is determined that oxygen is present in the condensate, appropriate mechanical steps can be taken to eliminate or minimize oxygen infiltration.

Carbon Dioxide Attack

Carbon dioxide is the most prevalent cause of return line corrosion, and its source is primarily the feedwater. An open or deaerating heater will remove any free carbon dioxide from the feedwater, but such removal will not eliminate the presence of carbon dioxide in the steam. Since bicarbonates and carbonates present in boiler feedwater will undergo decomposition at elevated temperatures to form carbon dioxide, the result of this decomposition is the chief source of carbon dioxide in the steam. The reactions are as follows:

(1) $2NaHCO_3 + \text{heat} \rightarrow Na_2CO_3 + CO_2 + H_2O$

bicarbonate + heat → carbonate + carbon dioxide + water

(2) $Na_2CO_3 + H_2O + \text{heat} \rightarrow 2NaOH + CO_2$

carbonate + water + heat → hydroxide + carbon dioxide

While reaction (1) will proceed to 100% completion, the decomposition indicated in reaction (2) proceeds to only about 80% completion. All other things being equal, the higher the carbon dioxide content of the steam, the greater will be the corrosion potential. The severity of the anticipated attack may be roughly estimated by conducting

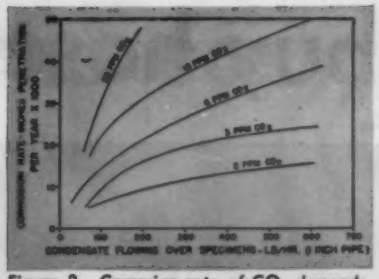


Figure 3—Corrosion rate of CO_2 depends on its concentration and flow rate. Note the drastic rate increase at concentrations above 6 ppm CO_2.

the phenolphthalein and methyl orange alkalinity determinations on the boiler feedwater. In some cases a carbon dioxide concentration as low as 6 ppm may cause a troublesome corrosion problem in the return piping.

However, in addition to the carbon dioxide concentration of the steam, there is one other important consideration in anticipating the severity of corrosion due to carbon dioxide. That consideration is the total pounds of carbon dioxide. Figure 3 clearly illustrates this point. It should be noted that with a carbon dioxide concentration of 6 ppm or above, the rate of corrosion increases rapidly as the rate of flow increases. Another factor which can materially influence the severity of carbon dioxide attack is the possibility of stratification. This leads to a higher rate of attack than expected for the particular flow rate and concentration of carbon dioxide.

Since the carbon dioxide contamination results from an actual breakdown of the carbonate and bicarbonate alkalinity of the feedwater, deaerating practices will be ineffective in reducing the corrosion potential due to this gas. Effective reduction of the corrosion potential may be achieved by external treatment of the feedwater or makeup water to reduce the bicarbonate alkalinity thereof. Such external treating facilities include lime-soda, and lime-gypsum softening, which ordinarily reduce the alkalinity to the 50-60 ppm range. It is advisable, from the standpoint of reducing carbon dioxide corrosion to maintain the softener effluent alkalinity in the carbon-hydrate form, rather than in the form of bicarbonate-carbonate. Other external methods that can be employed to reduce bicarbonate alkalinity to a very low level include acid feed, hydrogen zeolite softening, and dealkalization.

Neutralizing and Filming Amines

When external softening cannot produce a sufficiently low carbon dioxide concentration of the steam, or when the expense for such external treating facilities is not justified, excellent protection from attack can be achieved with the use of neutralizing amines or filming amines.

Neutralization of carbon dioxide can be safely accomplished by certain volatile amines. These amines, when fed to a boiler, volatilize with the steam and combine with the carbon dioxide to neutralize its acidity. Since they react directly with carbon dioxide, the quantity required is proportional to the carbon dioxide content of the steam. Where large amounts of carbon dioxide are present, costs can become excessive.

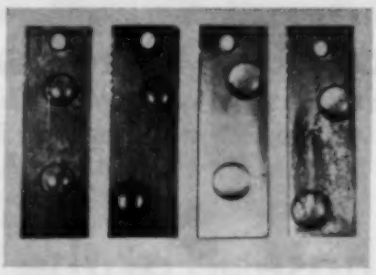


Figure 4—Non-wettability of amine film.

The filming amines function by laying a non-wettable film of monomolecular thickness over the metal surfaces, which is impervious to water. Since the film prevents the water from reaching the metal surface, attack is prevented. The quantity required is independent of the carbon dioxide concentration, and therefore is a more economical treatment particularly where high concentrations of this gas are present. The film forming amines are also effective when oxygen is present in moderate amounts. Figure 4 illustrates the water repellency of the amine film.

Summary

1. Oxygen and carbon dioxide are the chief causes of return line corrosion.
2. Attack by dissolved oxygen is characterized by pits and build-up of deposits of iron oxides.
3. Attack by carbon dioxide is characterized by grooving and actual thinning of the metal pipe walls.
4. Combined attack by oxygen and carbon dioxide will have the characteristics of each.
5. Oxygen attack can be stifled by efficient chemical and mechanical deaeration.
6. Carbon dioxide attack can be inhibited by external reduction of alkalinity and/or use of filming or neutralizing amines.

NEED NOT BE A PROBLEM

A number of factors must be considered on an *individual plant basis* to determine the best way to overcome a return line corrosion problem. Continuing research and development by BETZ LABORATORIES on this important subject has led to a better understanding of the effect of different variables, as well as provided increasingly effective control methods. A BETZ Field Engineer will be happy to discuss your return line corrosion problem and suggest result-producing ways to overcome it. Why not take steps to call him in *now* while you're thinking about it?

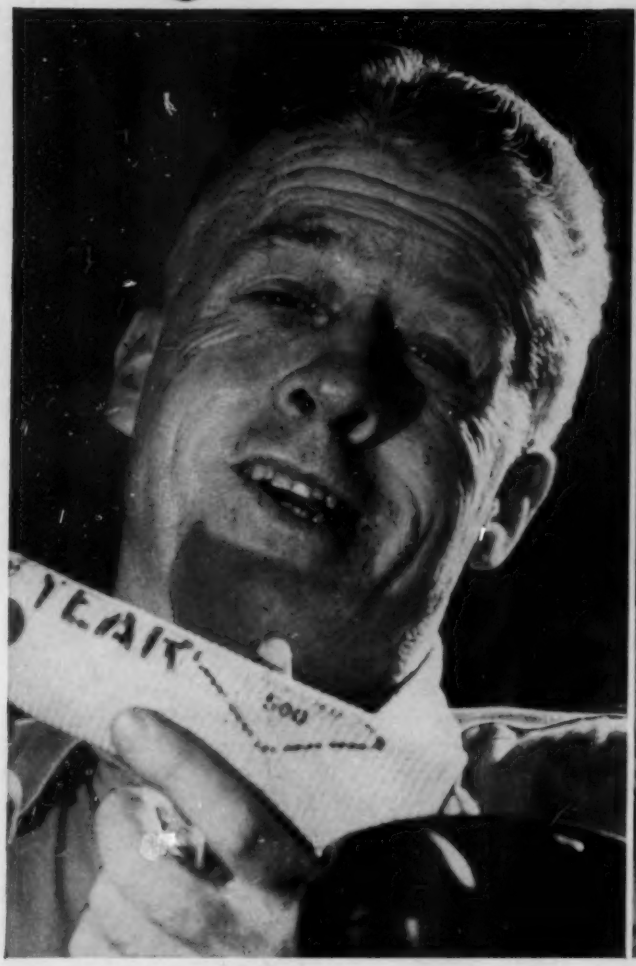
BETZ LABORATORIES, INC.

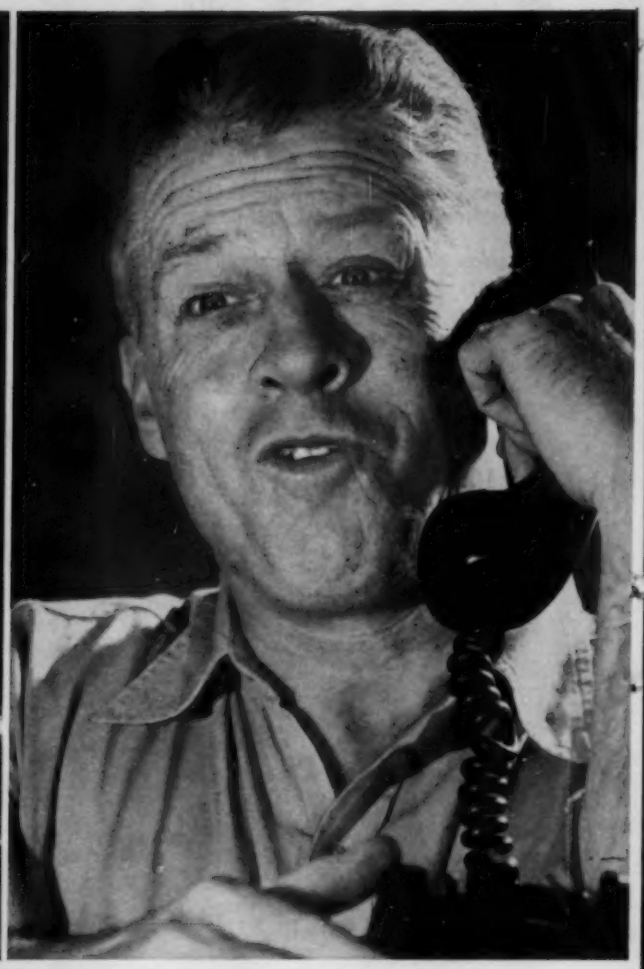
Gillingham & Worth Streets • Phila. 24, Pa.

■ CONSULTANTS ON INDUSTRIAL WATER PROBLEMS

GOODYEAR

Why not buy hose





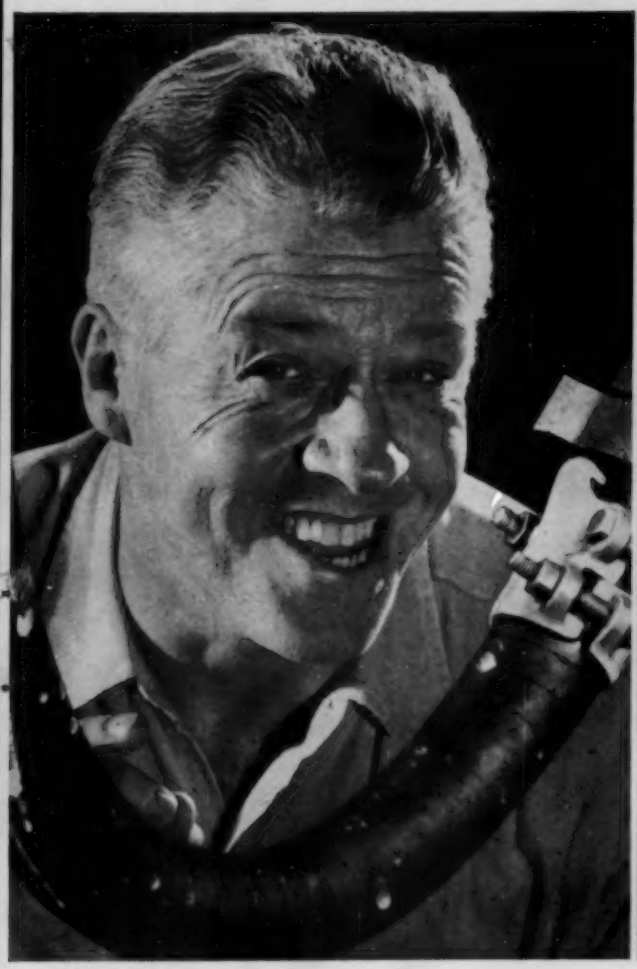
YOU GET THE RIGHT HOSE
(With the world's largest, most diversified line of industrial hose to choose from, *it's easy with Goodyear!)*

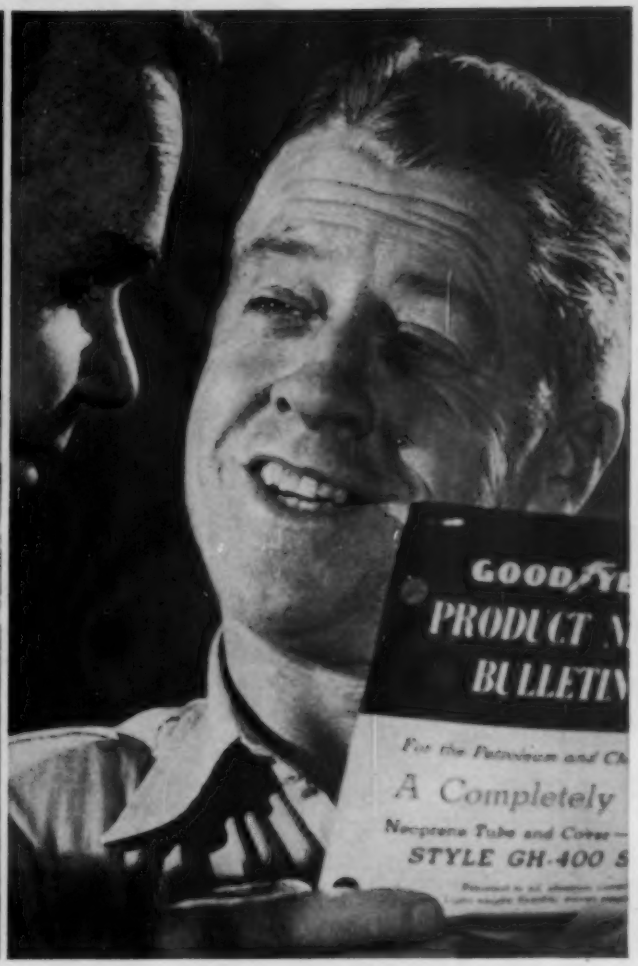
YOU GET FAST DELIVERIES
(With a big, nationwide network of stocking distributors to serve your needs, *it's easy with Goodyear!)*

For the right hose... at the right place... at your Goodyear Distributor... first in service

Lots of good things come from **GOOD**

the easy, Goodyear way?





YOU GET UNMATCHED QUALITY
(With more than 50 years of pioneering research and development backing hose quality, *it's easy with Goodyear!)*

YOU GET EXPERT ADVICE
(With a trained hose expert like the G.T.M. – Goodyear Technical Man – always on call, *it's easy with Goodyear!)*

the right time... at the right price... call with all industrial rubber products

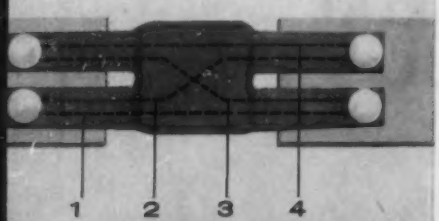
Or write Goodyear, Industrial Products Division, Akron 16, Ohio

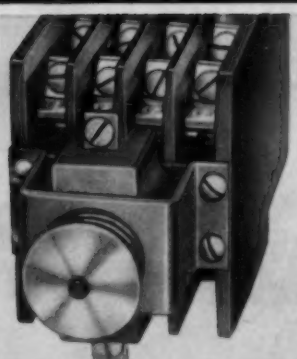
GOODYEAR INDUSTRIAL PRODUCTS

For more facts circle 508 on Reply Card

Another Cutler-Hammer first! Up to 24 poles in an area less than the size of a dollar bill.

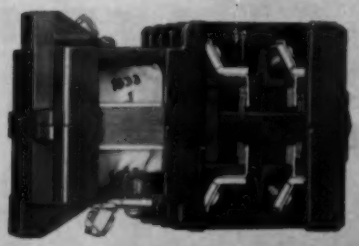
New contact reliability. Parallel bifurcated contacts, which allow four current paths instead of one, provide infinitely greater circuit reliability . . . liberally designed so any current path carries full relay rating.





At last! "Mechanical memory" latch as reliable as the relay itself! No adjustment ever needed. Add latch at any time.

New simplified design! Cutaway view shows basic simplicity. Coil vacuum impregnated to resist damage from humidity, vibration, electrical stress. Terminals can be screw or spade type.



Space savingest relay you've ever seen: New Cutler-Hammer "Compact 300"

Versatile 300 V. control relay is so reliable it's permanently sealed!

Here is the best answer yet to the need for an extremely reliable, small-size 300 *V*, 6 amp., industrial relay — the new "Compact 300" from Cutler-Hammer.

Every detail known that affects relay reliability has been improved in the "Compact 300." Bifurcated contacts which make possible *four* current paths rather than one, add millions of operations to the "Compact 300's" electrical reliability.

In fact, we're so confident of its electromechanical reliability, we permanently enclose the "Compact 300." And, if it should be damaged by a fault current, you throw it away and replace it with a new one. Its low price makes this an economical, practical maintenance procedure.

Now think of the space you can save with the "Compact 300." It controls up to eight circuits in panel space only 2″ wide by 2¾″ high. 2, 3, 4, 6 and 8 poles with any combination of N.O. or N.C. contacts are available, of course.

At any time, you can add "mechanical memory" latch with a life equal to the life of the relay. No adjustments are ever necessary. Contact your Cutler-Hammer distributor for details on the "Compact 300" or send for Pub. LO79-E274.

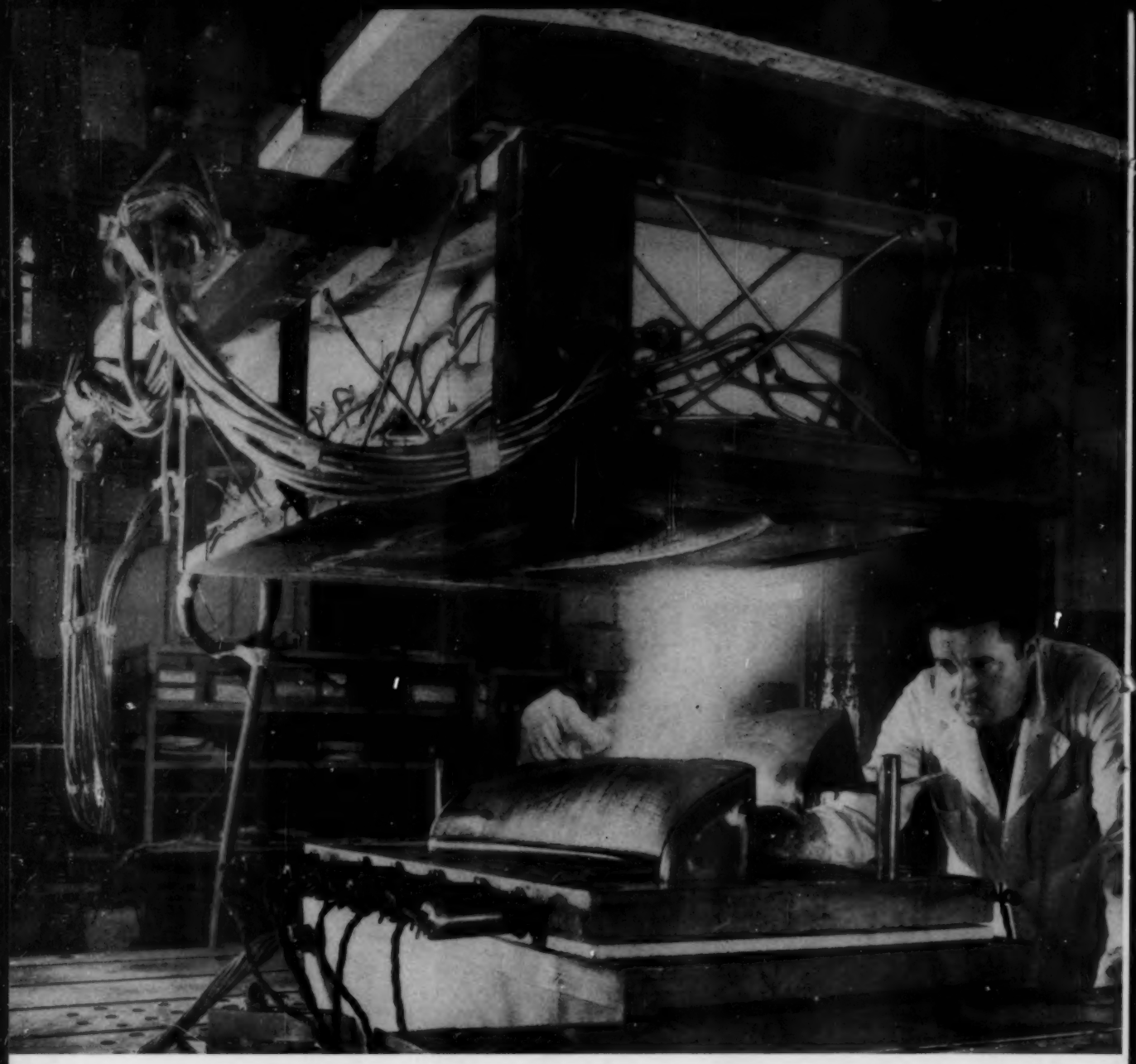
What's new at Cutler-Hammer? New, better products, like the 300 V. relay are coming steadily from our new, expanded plant facilities. We're ready now to help you take care of the great industrial growth of the future. If you are planning ahead and need electrical control assistance, contact the nearest Cutler-Hammer sales office.

WHAT'S NEW? ASK...

CUTLER-HAMMER

Cutler-Hammer Inc., Milwaukee, Wisconsin • Division: Airborne Instruments Laboratory • Subsidiary: Cutler-Hammer International, C. A. Associates: Canadian Cutler-Hammer, Ltd.; Cutler-Hammer Mexicana, S. A.

For more facts circle 509 on Reply Card



Gulf Harmony® oil has the extra stability press operation at Chance Vought...

Chance Vought Corporation, Dallas, Texas, developed a unique production technique to speed production of jet fighters. It's a 1000-ton press with electrically heated dies that permits the forming and stress-relieving of a titanium part in one operation.

However, this advanced technique created several problems. One, according to Doy Stanley, General Foreman, Facilities, was the heavier burden placed on operating parts of the press. When forming and stress-relieving were combined in one operation, high temperatures and pressures had to be applied for long periods of time. Under these conditions, maintenance of the press is very important. According to Mr. Stanley, "We've always stressed efficiency in our operation. And downtime is, as you might say, doubly inefficient."

Proper lubrication of hydraulic mechanisms and other press parts subjected to elevated temperatures and pressures is a must to keep production right on schedule. Says Mr. Stanley: "We have never had any

F8U Navy fighters near the end of the assembly line. Aircraft's leading edges use titanium part that has been formed and stress-relieved in one operation.

Doy Stanley, left, discusses hydraulic oil applications with Grover Garrison, Gulf Sales Engineer. Hamilton Press shown in background is one of various presses at Chance Vought that use Gulf Harmony oil.

On this 1000-ton press, simultaneous forming and stress relieving of titanium takes place at 1000 deg. F. Quality Gulf Harmony oil protects the vital hydraulic system.

needed for high temperature
GULF MAKES THINGS RUN BETTER!

downtime, or any trouble at all that can be attributed to lubrication. This excellent record is due mainly to the fact we use a high quality hydraulic oil that won't break down under heat."

That "high quality hydraulic oil" Mr. Stanley refers to is Gulf Harmony. It not only withstands heat, but resists oxidation, which improves service life and prevents sludge formation. Also, a corrosion inhibitor guards against rust, and an anti-foaming additive assures a smooth transfer of power.

If you have problems involving hydraulic fluids, or any petroleum product application, may we have the opportunity to prove to you that Gulf makes things run better! Call your nearest Gulf office, or write us for additional information.

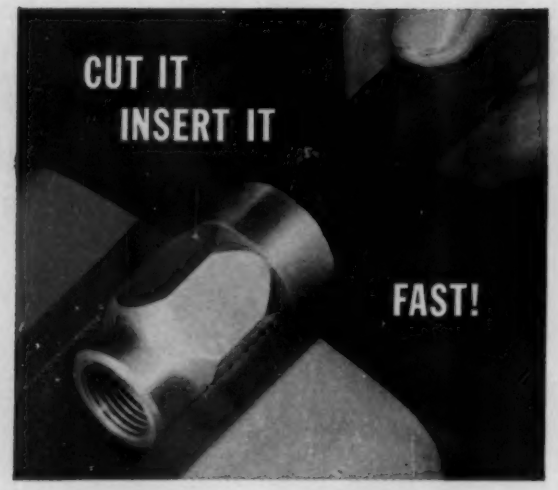
GULF OIL CORPORATION
Dept. DM, Gulf Building
Houston 2, Texas

GULF

For more facts circle 510 on Reply Card

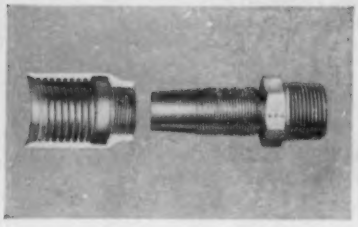
Save Hose Replacement Dollars.

Using PARKER Fittings with PARKER Hose to make Replacement Assemblies Faster



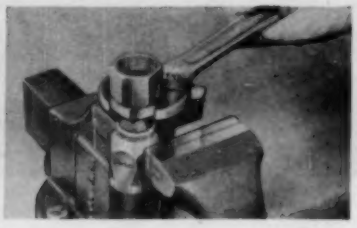
Installing Parker "Hoze-lok®" Fittings on Parker "No-Skive" Hose . . . NO SKIVING!

Installing ordinary fittings on ordinary rubber-covered hose . . . First, this messy skiving job.



Design of the "Hoze-lok" socket (left) makes the difference. The deep-tapped threads accept the **controlled thickness** rubber cover of Parker "No-Skive" Hose as they plow their way down to the wire braid of the hose. The rubber is displaced, not removed.

Just screw the hose in counter-clockwise, by hand. The rubber cover fills completely the space between each thread. It both protects and cushions the wire braid, eliminating a major cause of hose failure. A little Parker "Threadlube" is needed here.



The nipple, which is also the hose end fitting, screws in last, clockwise, in the usual way. You are now ready to make up the other end of your Parker No-Skive Hose Assembly. This method is not only faster; it gives you a better assembly. See next page.

You can install a Parker "Hoze-lok" Fitting on small-diameter Parker "No-Skive" Hose in 60 seconds. On 3/4" Parker hose, it takes 2 minutes or less. On very large sizes, allow 5 minutes per fitting. Hose replacement time is reduced to minutes the Parker No-Skive Way!

..*the* Parker No-Skive Way

Why Parker No-Skive Hose Assemblies Last Longer

BETTER PROTECTION FOR THE HOSE AT ITS POINT OF GREATEST STRESS

Most hose failures result from flexing. Ordinary hose, skived to the bare wire at the critical point where the first thread of the hose fitting bears directly on the wire braid, fails right there. As our picture shows, the leading thread of Parker "Hoze-lok" Fittings cannot reach the wire. The cushioning effect of the compressed rubber between the threads reduces the stress concentration at this point. Gripping by direct contact between the deep-tapped "Hoze-lok" threads and the wire braid occurs well within the fitting, where no flexing occurs.

Actual tests prove the effectiveness of this better design feature. Parker "Hoze-lok" assemblies on Parker "No-Skive" Hose rarely fail at the fitting, even when stressed to the burst point.

HOW PARKER DEVELOPED A BETTER HOSE TO MAKE THESE SAVINGS POSSIBLE

Parker "Hoze-lok" Fittings can be used with any hose, but you still have to skive ordinary rubber-covered hose, even with "Hoze-lok" fittings. Parker "No-Skive" Hose, however, is made to rigid specifications that limit and *control* the thickness of the cover to the exact amount of rubber that the corresponding size of "Hoze-lok" fitting will accept, when attached without skiving.

In all other characteristics, from the inner liner to the OD of the outermost wire braid, Parker "No-Skive" Hose conforms to S.A.E. specifications. In addition, because only a better grade of rubber compound can be extruded to Parker's exacting *controlled thickness* specification, the increased resistance to abrasion of the Parker "No-Skive" rubber cover results in a better hose.

Parker FITTINGS AND HOSE DIVISION

17325 Euclid Avenue • Cleveland 12, Ohio

PNEUMATIC AND HYDRAULIC SYSTEM COMPONENTS

ARRANGE NOW FOR A PARKER NO-SKIVE DEMONSTRATION IN YOUR OWN PLANT OR OFFICE

Gentlemen: We would like to see the Parker No-Skive Way to make up replacement hose assemblies demonstrated, without any obligation on our part, of course.

Please ask your salesman or nearest "Hoze-lok" distributor to get in touch with me:

Name_____

Title, Department or Division _____

Company_____

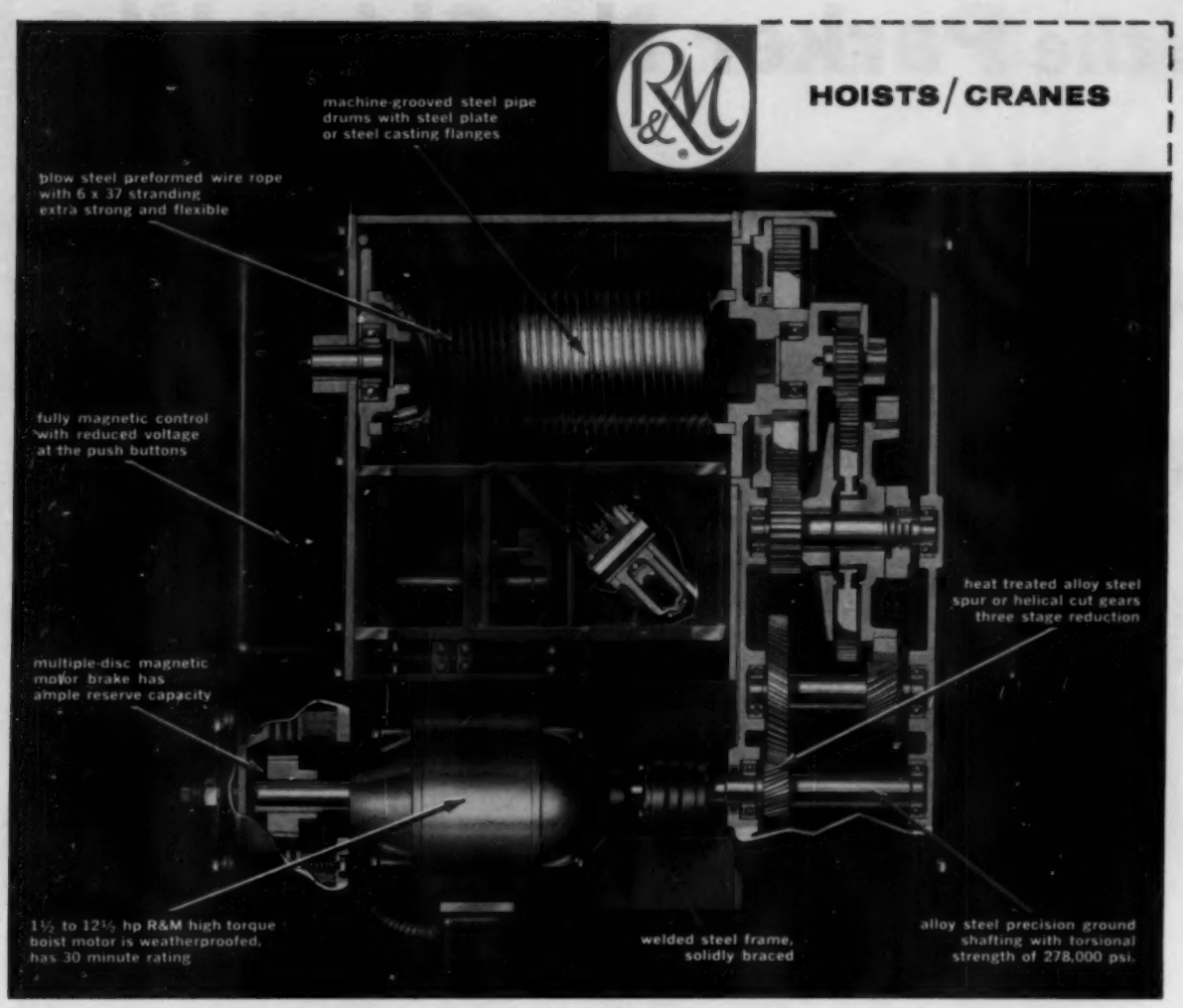
Address_____

City_____ Zone_____ State_____

We use hose for_____

3079-PH

For more facts circle 511 on Reply Card


HOISTS / CRANES
machine-grooved steel pipe drums with steel plate or steel casting flanges
plow steel preformed wire rope with 6 x 37 stranding extra strong and flexible
fully magnetic control with reduced voltage at the push buttons
heat treated alloy steel spur or helical cut gears three stage reduction
multiple-disc magnetic motor brake has ample reserve capacity
1½ to 12½ hp R&M high torque hoist motor is weatherproofed, has 30 minute rating
welded steel frame, solidly braced
alloy steel precision ground shafting with torsional strength of 278,000 psi.

LOW HEADROOM HOIST FOR HARD USE

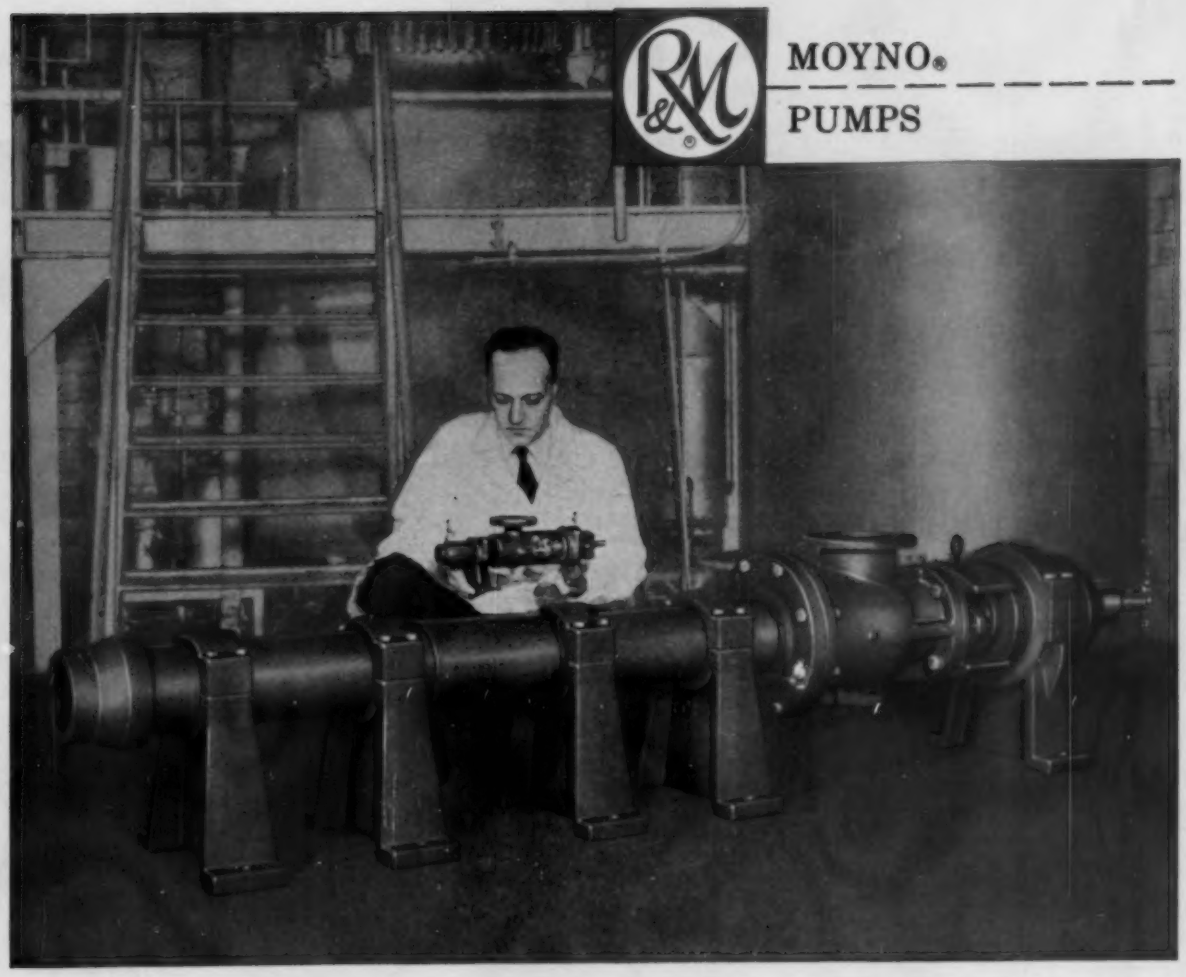
Robbins & Myers heavy duty Type F hoists have compact, beam-hugging profiles to save overhead space in your plant. For example, the F-2 has a headroom of only 17", yet provides 2 ton lifts on a path of steel extending from beam to hook. And F hoists are built for toughest use: frame is welded steel, alloy steel gears are heat treated, ball and roller bearings are used throughout. Weatherproof R&M 220/440 v.a.c. motors—to 12½ hp—drive through three gear reductions. These are the hoists to choose for day-after-day production lifting where maximum dependability is important. You can standardize on F hoists throughout your plant because the line is as economical as it is broad: capacities—½ to 10 tons, mounting—lug, plain or geared hand trolley, 3 types of motorized trolleys. Request Bulletin 920. Hoist & Crane Division of Robbins & Myers, Inc., Springfield, Ohio or Brantford, Ontario.

Type F hoists: over forty speed-load choices.

ROBBINS & MYERS

hoists & cranes, Moyno® pumps, motors, Propellair® fans

For more facts circle 512 on Reply Card



MOYNO®
PUMPS

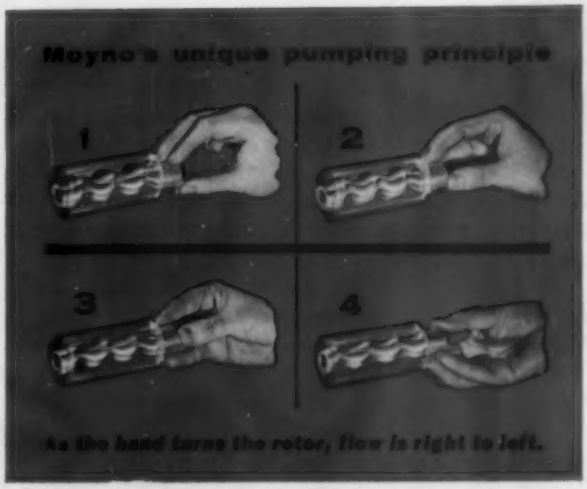
MOYNO® PUMPS

capacities: from 1/100 to 500 gpm
pressures: up to 1000 psi

MOYNO pumps are available in nine sizes with capacities ranging from minimum metering flow to 500 gpm and pressures from zero to 1000 psi. Positive displacement delivers uniform discharge without pulsation, agitation or turbulence. Solutions ranging from thin watery slurry to extremely viscous paste, corrosives, abrasives and even solids in suspension are economically handled without excessive pump wear.

MOYNO's unique *"progressing cavity"* principle with only one moving part and special resistant internal parts slashes pump maintenance costs on problem materials that often ruin other pumps. Almost any substance that can be forced through a pipe can be pumped by a MOYNO.

To learn how a MOYNO can cut your pumping costs, write today for Bulletin 30 PE.



ROBBINS & MYERS, INC.

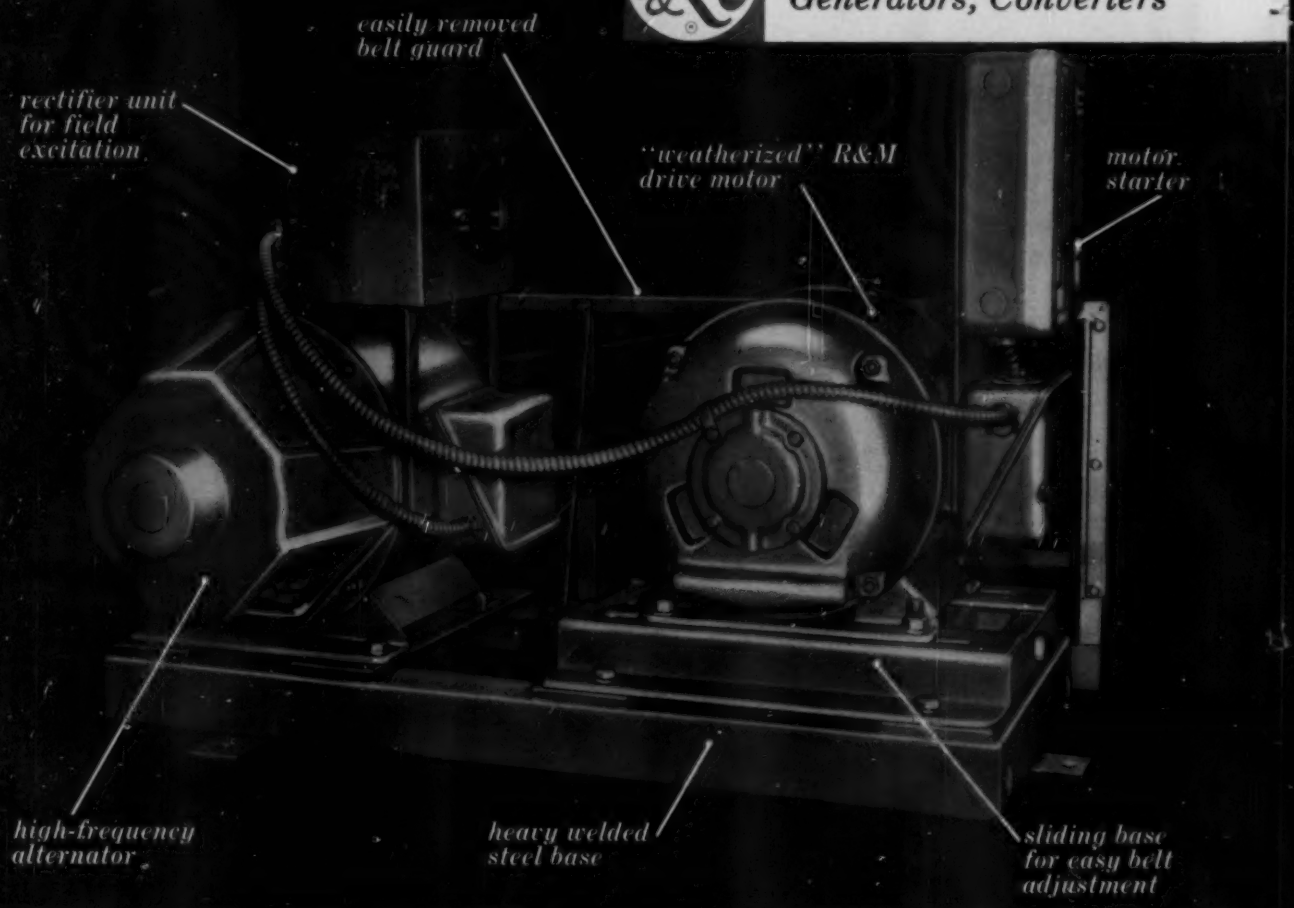
motors, household fans, Propellair industrial fans, hoists, Moyno industrial pumps

SPRINGFIELD, OHIO • BRANTFORD, ONTARIO

For more facts circle 513 on Reply Card

high frequency

Generators, Converters



Compact High Frequency Power Generators

360 to 3300 cycles

R&M package high cycle generators provide dependable current beyond the practical range of frequency converters. Rugged revolving field construction is used in ratings of 1500 cycles and lower. Ratings above 1500 cycles are brushless inductor design. Excitation of DC alternator field is provided by simple silicon rectifiers, protected against short circuits by time-delay fuses. For changing output frequency, R&M can furnish variable pitch pulleys or variable speed drives. R&M's low-cost frequency converters make 220 volt-3 phase-120 through 420 cycle power available from 60 cycle supply . . . rated 2½KW (horizontal construction) 5, 7½ and 10KW (vertical).

Write today for bulletin 515A-PE!

ROBBINS & MYERS, INC., Springfield, Ohio

Fractional and Integral HP Electric Motors • Electric Hoists and Overhead Traveling Cranes • Moyno® Industrial Pumps
Propellair® Industrial Fans • R & M-Hunter Fans and Electric Heat • Trade-Wind Range Hoods and Ventilators
Subsidiary companies at: Memphis, Tenn., Pico Rivera, Calif., Brantford, Ontario.

For more facts circle 514 on Reply Card

BULLETINS

JUST RELEASED and OF IMMEDIATE PLANT INTEREST

CONSTRUCTION

Versatile Pole Buildings—Plant engineers seeking more usable floor space per building dollar will find helpful information in Bulletin W-388 on expandable clear-span buildings of pole and truss design. Besides listing specifications and design notes, bulletin illustrates through drawings, ease of construction of basic shell, and how width of building can be expanded in saw-tooth fashion. Other models of pole buildings are also shown. Wood Preserving Div., Koppers Co., Inc.
▲ For a copy, circle 101 on Post Card

Steel Products—Described in this 8-pp catalog are structural steel products, including square columns, shear heads, concrete columns, beams and girders, joists, truss, T-frames, tapered girders, domes and others. Specifications and safe load tables given. Shiagro Steel Products Corp.
▲ For a copy, circle 102 on Post Card

Fire-Resistive Roofs—Fire insurance savings which can be achieved with full fire-resistive roof decks are detailed in 16-pp Form L22. Describes factors that effect fire insurance rates, and shows three types of roof construction, with insurance costs for each. The Flexicore Co., Inc.
▲ For a copy, circle 103 on Post Card

Modular Wall System—Details and specification on a movable modular wall system with panels 2½-in. thick are presented in this 16-pp bulletin. Illustrates typical finishes and construction details and includes complete specifications. The E. F. Hauserman Co.
▲ For a copy, circle 104 on Post Card

Movable Interior Walls—Descriptive details and specifications on movable interior walls which combine strength and slim lines are presented in this 32-pp bulletin. Suggested applications are given and advantages detailed along with construction diagrams. The E. F. Hauserman Co.
▲ For a copy, circle 105 on Post Card

Rolling Doors, Partitions—Illustrated and described in 20-pp Bulletin 6101 are steel and aluminum rolling doors, fire doors, rolling grilles and side-coiling grilles, extruded aluminum counter doors, and wood side-coiling partitions. Architectural specifications and selection charts are included. The Cookson Co.
▲ For a copy, circle 106 on Post Card

Economical Floor Modernization—Reasons for selecting brick when modernizing floors in processing, chemical and allied industries are discussed in this 8-pp bulletin. Pictures of typical installations are included and benefits are listed. Drehmann Paving and Flooring Co.
▲ For a copy, circle 107 on Post Card

Bactericidal Floor—Bactericidal properties of company's specially treated concrete floors are detailed in this 8-pp product bulletin. Describes the bactericidal agent—a nonmoisonous metal in the form of a colloid or salt—and includes specifications. Kalman Floor Co., Inc.
▲ For a copy, circle 108 on Post Card

Improved Fire Door—Eight-pp Form DHSL presents the sliding Pyrodor, a fire door with flush design and UL-approved Pyromatic release designed to close door automatically in event of fire, yet permit manual operation at all times. A cutaway shows its operation and mechanism. Also illustrated are mineral core construction, armored edges, concealed hardware. Several installations are pictured. Dusing & Hunt, Inc.
▲ For a copy, circle 109 on Post Card

For Longer Lasting Concrete—Products for improvement of concrete and mortar are described in this 12-pp 1960 industrial catalog. Covers the iron-armored concrete floor and various floor products, non-shrink grout, concrete and mortar, pre-mixed grout and mortar. The Master Builders Co.
▲ For a copy, circle 110 on Post Card

Good Grouting Methods—Text and photos in 8-pp Bulletin EPMG-2a, explain proper methods for grouting different types of heavy industrial equipment. Non-shrink Embeco premixed grout is used to explain methods and techniques. Preparatory steps shown. Master Builders Co.
▲ For a copy, circle 111 on Post Card

MAINTENANCE

Chemical Resistant Enamel—Technical Bulletin 1001 describes Corlar, an epoxy chemical resistant enamel for abnormal exposures to fumes, spillage and moisture. Covers characteristics, applications, coverage and surface preparation. E. I. du Pont de Nemours & Co., Inc.
▲ For a copy, circle 112 on Post Card

Activated Epoxy Coating—Technical data on activated epoxy coatings designed to withstand sustained abuse and corrosive attack is presented in this product bulletin. Includes color discs and specifications. The Wilbur & Williams Co., Inc.
▲ For a copy, circle 113 on Post Card

For Floors Without Flaws—Detailed information on company's floor products is tabulated in this product bulletin. Covers colored and natural floor hardeners, patching and resurfacing compounds, chemical resistant coatings, primers and epoxy and slip resistant coatings. A. C. Horn Companies, Sun Chemical Corp.
▲ For a copy, circle 114 on Post Card

Industrial Vacuum Cleaner—Large capacity industrial vacuum cleaners are illustrated and described in this product bulletin. Also lists hose and optional equipment for the large capacity units. Clements Mfg. Co.
▲ For a copy, circle 115 on Post Card

MATERIALS HANDLING

Standard Conveyors—Construction details and descriptions of company's standard conveyors and conveyor systems are presented in this 20-pp bulletin. Describes conveyor components such as take-up units, power units, power accessories, drum, rollers and bearings. Food Machinery and Chemical Corp.
▲ For a copy, circle 116 on Post Card

Plan-It-Yourself Conveyor—Bulletin 500, 20-pp, shows how to plan and install a conveying system to suit job requirements, providing specifications, illustrations and examples of typical installations. Includes plotting forms, working tables and a check list for developing individual systems. Conveyor Systems, Inc.
▲ For a copy, circle 117 on Post Card

Postage-free Reader Service Cards for your convenience in ordering these bulletins are provided on pages 223-224. You may also use the post cards for ordering any literature mentioned in the ads.

Adjustable Pressure Conveyors—Eight-pp Catalog 1200 describes wheel and live roller APC conveyors that permit accumulation on powered horizontal conveyor with no pressure build-up. Specifications and photos of typical installation included. The Rapids-Standard Co., Inc.
▲ For a copy, circle 118 on Post Card

Conveyor Belt Selector—This 12-pp booklet includes a guide to correct selection of conveyor belts for food and package handling. Belts are rated on the chart for resistance to abrasion, high temperatures and oil and grease resistance. Several belt constructions are described in detail and illustrated in color, including Green Pack and Koroseal. B. F. Goodrich Industrial Products Co.
▲ For a copy, circle 119 on Post Card

For Bulk Handling—Featured in 16-pp Bulletin TV-98 is a totally enclosed bulk material handling conveyor featuring a two directional chain to convey in any direction. Typical systems are diagrammed. Prab Conveyors, Inc.
▲ For a copy, circle 120 on Post Card

Crane Building Blocks—General Catalog 61A is a 64-pp manual on hoists, cranes and crane components. Illustrates and describes end trucks, enclosed conductors, hoists, crane drives and fluid drive motors, trolleys, runway rails, hanger fittings and other components for building

PRE-COOLERS FOUND CONTRARY TO UNIFORM PLUMBING CODE

Sponsors of UPC UNIFORM PLUMBING CODE

Resolution #2, Passed October 7, 1960
31st Annual Conference
WESTERN PLUMBING OFFICIALS ASSOCIATION

Whereas the Western Plumbing Officials Association has worked continuously with the industry to improve plumbing fixtures, equipment, and appliances and

Whereas acceptable standards are found frequently to be incomplete or lacking in complete details to serve as a complete guide for manufacture of plumbing products and

Whereas requests to the industry to discontinue a practice in construction is as effective as legislation or changes to a standard, now

Therefore be it resolved the manufacturers of refrigerated drinking fountains be and hereby are requested to discontinue the practice of installing cooling fins in the drain lines of coolers for pre-cooling purposes. Such obstructions being contrary to the provisions of the Uniform Plumbing Code.

NEW SUNROC COOLERS WITH PACKAGED COOLING have no pre-cooler.

Get complete details on PACKAGED COOLING in these new SUNROC Coolers:

NAME_____
FIRM_____
ADDRESS_____
CITY_____
ZONE____ STATE_____

☐ Wall-Hung Coolers
☐ Flush-to-Wall Coolers
☐ Remote Coolers
☐ Column Mounted Coolers

SUNROC CORPORATION
GLEN RIDDLE, PA. • In Canada—Frigidaire of Canada
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BULLETINS

(Begins on page 21)

top riding and underslung cranes from 1-to 15-ton capacity. Consolidated Crane & Engineering Corp.
▲ For a copy, circle 121 on Post Card

Crane Signal Chart—This letter-size decal chart is designed for installation in crane cabs and other spots for ready reference. Gives standard hand signals for hoisting, lowering, stopping. Ederer Engineering Co.
▲ For a copy, circle 122 on Post Card

Industrial Hose Handling—Ideas for improved industrial hose handling are discussed in this 16-pp booklet. Covers production, tool operation, testing, cleaning, maintenance, servicing, welding, fueling, fire protection. Clifford B. Hannay & Son, Inc.
▲ For a copy, circle 123 on Post Card

PUMPS

Centrifugal Pumps—Single stage, double suction centrifugal pumps are described in 16-pp Bulletin 721.6. Complete specifications, interchangeability chart, performance curves and dimensions are included. Goulds Pumps, Inc.
▲ For a copy, circle 125 on Post Card

Rotary Gear Pumps—Described in Bulletin 43 are rotary gear pumps individually designed for specific applications in handling materials with viscosity ratings from 300,000 to 30 ssu. Dimensional and ratings data included. Northern Ordnance Inc.
▲ For a copy, circle 126 on Post Card

For Leak-Proof Pumping—Bulletin 2050 describes features of the Series G Chempump . . . automatic thrust balance, large bearings, oil filled stator cavity. Also includes performance curves and detailed cross-section of the pumps. Chempump Div., Fostoria Corp.
▲ For a copy, circle 127 on Post Card

MECHANICAL POWER TRANSMISSION

Timing-Belt Drives—Detailed information on timing-belt drives for mechanical power transmission for load capacities from fractional to 600 hp and for belt speeds to 16,000 fpm is presented in 80-pp Catalog 19103. Complete selection tables are designed to provide needed information with minimum of calculation, including determination of driven pulley and belt pitch length when speed ratio and driver pulley are known. T. B. Wood's Sons Co.
▲ For a copy, circle 128 on Post Card

Universal Drive Tensioner—Featured in this product bulletin is a universal drive tensioner designed to provide controlled tensioning for smoothness and efficiency of operation. Brewer Machine & Gear Co.
▲ For a copy, circle 129 on Post Card

V-Belt Fasteners—Alligator V-belt fasteners for installation on all types of drives are illustrated and described in 6-pp Bulletin V-227. Tells how to determine belt length for existing drive installation, and includes detailed selection data. Flexible Steel Lacing Co.
▲ For a copy, circle 130 on Post Card

Industrial Brakes—Bulletin CE-410 describes company's DC Series magnetic brakes for general use in industry; and Bulletin CE-420 describes their positive acting solencid brakes for general industrial use. Ratings and clearances are given. Ederer Engineering Co.
▲ For a copy, circle 131 on Post Card

Improved Couplings—Detailed information on torsionally resilient Steelflex couplings is presented in 24-pp Bulletin 4100. Charts and tables contain engineering data and photos and diagrams illustrate design and construction features. The Falk Corp.
▲ For a copy, circle 132 on Post Card

Cast Couplings—Described in 12-pp Form 216 are cast couplings for all classes and sizes of cast iron or asbestos-cement pipe. Features and applications are covered and specifications included. Smith-Blair Inc.
▲ For a copy, circle 133 on Post Card

Holdback Clutches—This 12-pp catalog describes holdback clutches designed to prevent runback or reverse travel of inclined conveyors, bucket elevators, capstans and related handling or operating equipment. Tells why and where these clutches are used; explains how they operate, and cites major design advantages. Provides tables and charts covering speed and idler factors, and engineering, dimensional and mounting data. Formsprag Co.
▲ For a copy, circle 134 on Post Card

Automatic Clutches—Featured in 42-pp Catalog 142 is a line of automatic centrifugal clutches and clutch couplings designed for industrial power transmission applications. Covers basic functions, principal advantages and performance characteristics and includes tables, charts and graphs covering horsepower ratings, service factors, typical mounting arrangements. Formsprag Co.
▲ For a copy, circle 135 on Post Card

HEATING

For Controlled Heat—Electric heaters for industrial service are illustrated and described as to features and application in 20-pp Bulletin EC-261-R. Forced air, natural convection, radiant and infra-red types are included. Bulletin discusses safety factors, provides capacities, dimensions, mounting data. Electromode Div., Commercial Controls Corp.
▲ For a copy, circle 136 on Post Card

For Space Heating—Twenty-pp Bulletin 71 presents NiaWel hot water converters for space heating service. Besides giving specifications covering 114 models in two- and four-pass arrangements, bulletin describes ASME construction of shells and removable U-tube bundles, available metals and alloys for special fabrications. Provides illustrated method for selecting correct size shell and heating surface. Niagara Weldments Inc.
▲ For a copy, circle 137 on Post Card

PIPING, VALVES, FITTINGS

Overhead Pipe Systems—Plasti-Clad prefabricated insulated pipe systems for overhead lines are described as to construction and application in 6-pp illustrated Form PC-11. Includes data on suggested pole spacing. RicwiL Inc.
▲ For a copy, circle 138 on Post Card

Glassed-Metal Pipe—Applications of glassed-metal pipe, valves and fittings designed to prevent corrosion and protect product purity are described in 16-pp Bulletin 987. Cutaway drawings and detailed specifications and dimensions are included. Pfaudler Permutit Inc.
▲ For a copy, circle 139 on Post Card

Rugged Drainline—Sixteen-pp Bulletin 30 gives detailed information on Pyrex brand "double tough" drainline. Contains product and property data and lists advantages of the corrosion-resistant glass system for disposal of chemical wastes. Also gives details on available fittings. Photos, schematic drawings and charts included. Corning Glass Works.
▲ For a copy, circle 140 on Post Card

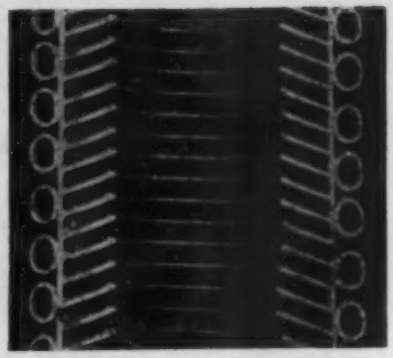
Sound Absorbing Pipe—Bulletin 866 covers SoundZorber wire-reinforced flexible rubber pipe. This pipe is designed to reduce noise and vibration disturbance in pipe line installations. Construction features and operating characteristics are discussed and sizes given. Also provided is comparison of acoustical impedances of this and other pipe. General Rubber Corp.
▲ For a copy, circle 141 on Post Card

Reader Service Cards for ordering bulletins are on pages 223 and 224. Be sure to give your company name and your own job title.

Valve Guide—Catalog 800-A contains 20 pp of detailed information and technical details on company's line of bronze valves, as well as pressure and temperature controls, solenoid valves and strainers. Includes descriptive data, comparative chart, estimated weight tables and material standards. Detroit Controls Div., American-Standard.
▲ For a copy, circle 142 on Post Card

Corrosion-Resistant Valves—Illustrated and described in 16-pp Bulletin 7 are corrosion-resistant valves, including gate, globe, angle, Y, check, flush bottom tank, and sampling valves and accessories. Includes engineering specifications and list of alloy materials, with chemical composition ranges, minimum mechanical properties. Alloy Steel Products Co.
▲ For a copy, circle 143 on Post Card

(More Bulletins on page 225)



Cut-away section of actual pre-cooler

- Pre-cooler fins collect foreign matter from bubbler spill water.
- Fins become clogged; cold drain water cannot flow over and around fins.
- Cold spill water flows directly down drain, does no pre-cooling.
- Satisfactory under lab conditions, pre-cooler clogs in actual use, loses its pre-cooling efficiency. Result—cooler capacity cut as much as ½.

New SUNROC Coolers with PACKAGED COOLING have no pre-cooler. Larger refrigeration system produces all the rated capacity—needs no pre-cooler boosting. Unless it's a New SUNROC with PACKAGED COOLING, a water cooler must be specified by capacity without pre-cooling. Only then will you get all the GPH you specify.

Send non-proprietary specification form on how to specify without pre-cooling.

NAME_____

FIRM_____

ADDRESS_____

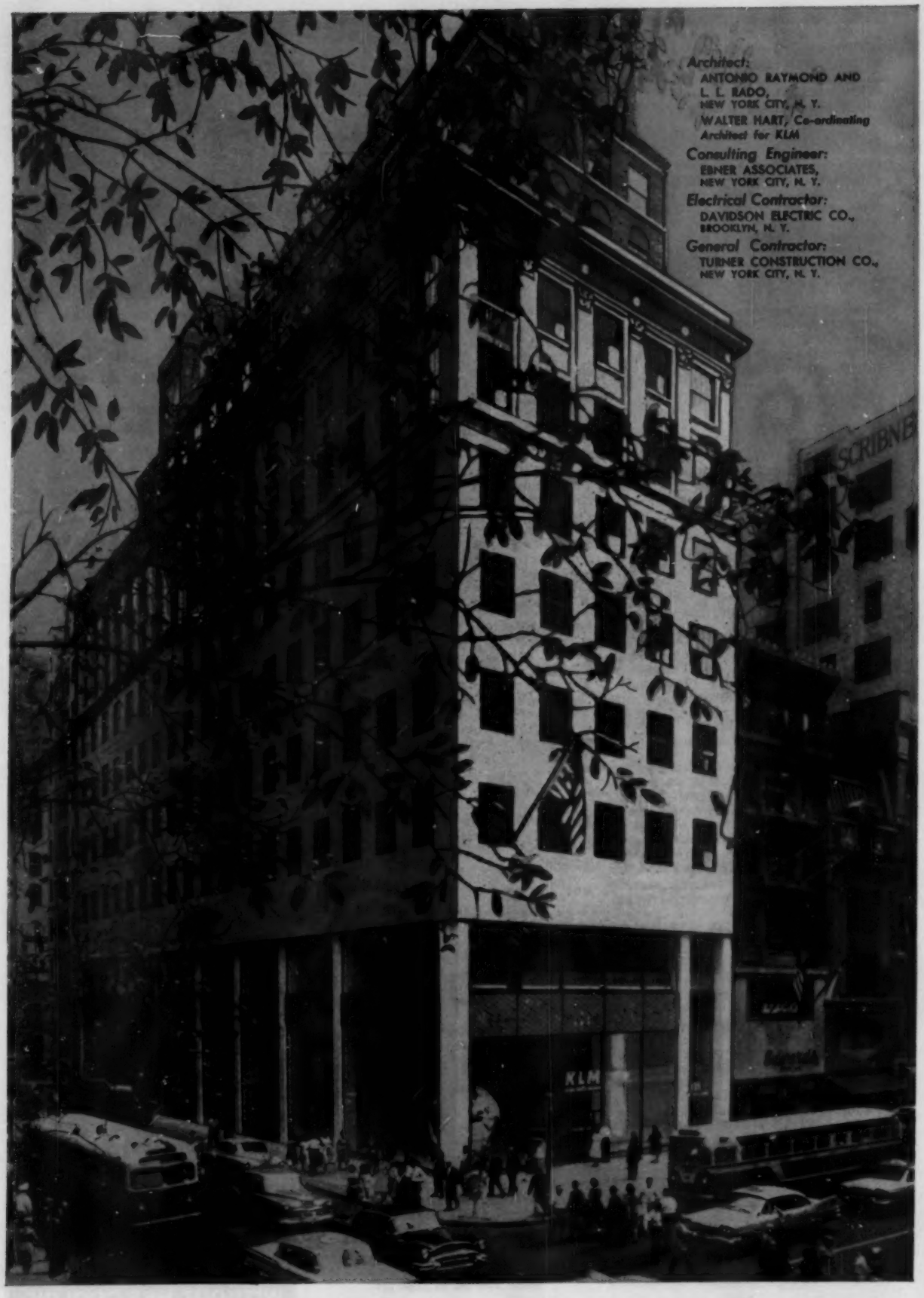
CITY_____

ZONE_____ STATE_____

SUNROC
CORPORATION
GLEN RIDDLE, PA. • In Canada—Frigidaire of Canada

WHY COOLERS MUST BE SPECIFIED BY GPH WITHOUT PRE-COOLING

For more facts circle 516 on Reply Card



Architect:
ANTONIO RAYMOND AND L. L. RADO,
NEW YORK CITY, N. Y.
WALTER HART, *Co-ordinating Architect for KLM*

Consulting Engineer:
EBNER ASSOCIATES,
NEW YORK CITY, N. Y.

Electrical Contractor:
DAVIDSON ELECTRIC CO.,
BROOKLYN, N. Y.

General Contractor:
TURNER CONSTRUCTION CO.,
NEW YORK CITY, N. Y.

Electrical Protection *is MODERNIZED* with BUSS fuses in the KLM Royal Dutch Airlines Building, New York City

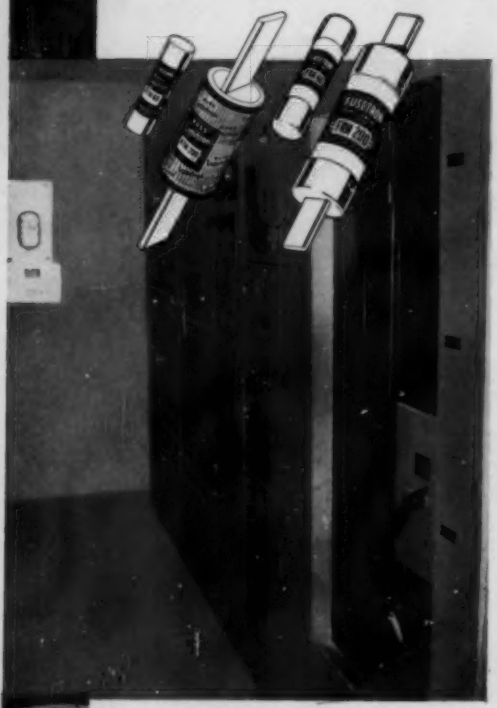
KLM INSTALLATION POINTS OUT THE NEED FOR SAFE INTERRUPTION OF HIGH FAULT CURRENTS

A 3 million dollar modernization program was recently completed on this 13 story office building at 609 Fifth Ave., which houses the American Executive and first floor ticket offices of KLM Royal Dutch Airlines.

To meet power requirements, the capacity of the electrical system was greatly increased, resulting in an estimated available fault current level approaching 100,000 amperes.

In the main switchboard, Buss LIMITRON fuses are installed to provide the high interrupting capacity necessitated by the available fault current and to give great current limitation needed to protect circuits and equipment.

To further assure safe protection and to safeguard against needless outages, distribution and feeder circuits are equipped with FUSETRON dual-element fuses.



Part of Main Switchboard Protected by:
3-3000 amp., 3-1200 amp., 6-1000 amp.,
BUSS LIMITRON FUSES and
15-400 amp., 3-350 amp., 3-275 amp.,
3-250 amp., 9-200 amp., 3-125 amp.,
3-90 amp.,
FUSETRON dual-element FUSES

Fuses Offer the Safest, Most Practical Solution to Modern Protection Requirements

As electrical network capacities increase, available fault currents of 75,000 to 100,000 amps and up are no longer uncommon.

In order to adequately safeguard circuits and equipment, it becomes imperative to install protective devices that can safely interrupt these fault currents.

HIGH INTERRUPTING CAPACITY

Fuses provide high interrupting capacity at a very low cost. Buss LIMITRON fuses have an interrupting rating of 200,000 amps. rms symmetrical — and for FUSETRON dual-element fuses it is 100,000 amps.

CURRENT LIMITATION

Buss LIMITRON fuses also provide current limitation so that fault currents are shut-off before equipment on the circuit can be damaged.

LIFE-TIME DEPENDABILITY

Fuses remain safe and accurate through the years. Fuses have no triggers, latches, pivots or contacts to stick or get out of order. They require no expensive maintenance or recalibration — they are always ready to function the instant trouble occurs.

To help you select the proper fuse, write for the new BUSS booklet . . .
BASIC PROTECTION FOR ELECTRICAL POWER SYSTEMS.

BUSSMANN MFG. DIVISION *McGraw-Edison Co.*
University at Jefferson, St. Louis 7, Mo.

For more facts circle 517 on Reply Card

For more facts circle 518 on Reply Card →

FALK

A GOOD NAME IN INDUSTRY

Ask for Bulletin 7100

Ask for Bulletin 7100

147 COMBINATIONS . . . horizontal or vertical applications . . . . .

UNIT SIZE	SHAFT MOUNTED DRIVES					
	RATIOS			MOTOR MOUNT	OVERLOAD RELEASE	BACK-STOP
	4	14	24*			
107J	X	X	X	X	X	X
115J	X	X	X	X	X	X
203J	X	X	X	X	X	X
207J	X	X	X	X	X	X
215J	X	X	X	X	X	X
307J	X	X	X	X	X	X
315J	X	X	X	X	X	X
407J		X	X	X	X	X
415J		X	X	X	X	X
507J		X	X	X	X	X

½ to 125 hp. Up to 100,000 lb-in. torque

UNIT SIZE	FLANGE MOUNTED DRIVES					
	RATIOS				BACK-STOP	MOTOR MOUNT
	4	9	14	24*		
107J	X	X	X	X	X	X
115J	X	X	X	X	X	X
203J	X	X	X	X	X	X
207J	X	X	X	X	X	X
215J	X	X	X	X	X	X
307J	X	X	X	X	X	X
315J	X		X	X	X	X
407J			X	X	X	X
415J			X	X	X	X
507J			X	X	X	X

*20:1 ratio for sizes 107 and 115

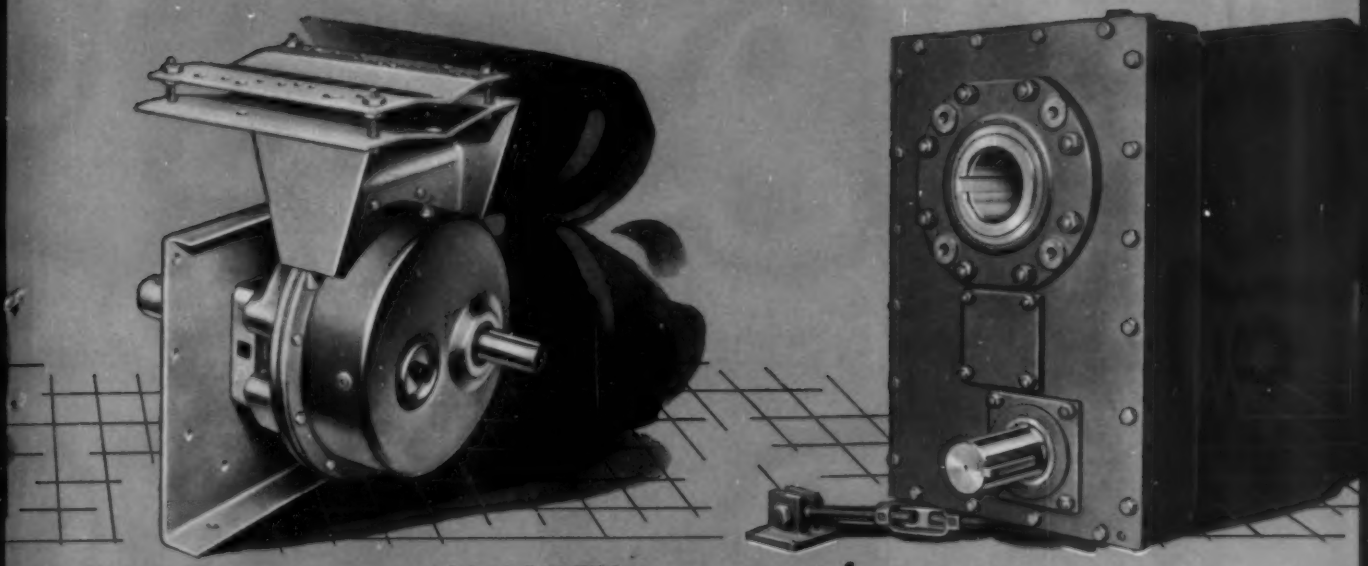
½ to 125 hp. Up to 100,000 lb-in.

Exclusively **FALK**... ***Adaptability of all these three types of Falk Drives for use with Equi-Poised Motor Mount.*** **This feature reduces costs of engineering and constructing motor bases and foundations.**

Exclusively **FALK**... ***Interchangeable rotating elements*** **size-for-size between Shaft and Flange Mounted Drives or Screw Conveyor Drives. This feature simplifies stocking and maintenance for large users.**

. the most complete line of SHAFT MOUNTED, FLANGE MOUNTED and SCREW CONVEYOR drives . . .

The line with the exclusive EQUI-POISED motor mount



Ask for Bulletin 7106

. . . . AVAILABLE FROM STOCK

UNIT SIZE	SCREW CONVEYOR DRIVES				
	RATIOS				MOTOR MOUNT
	4	9	14	24*	
107J	X	X	X	X	X
115J	X	X	X	X	X
203J	X	X	X	X	X
207J	X	X	X	X	X
215J	X	X	X	X	X
307J	X	X	X	X	X
315J	X		X	X	X
407J			X	X	X
415J					
507J					

½ to 40 hp. Up to 44,000 lb-in. torque

Exclusively **FALK...*Single helical gears* used in *all* sizes and types—they provide maximum (98½%) efficiency per gear mesh.**

FALK is a registered trademark

New 2 LARGER SIZES OF SHAFT MOUNTED DRIVES—415-507

Falk-designed and Falk-built for higher torque requirements, these all-steel, *helical* gear reducers are available in Shaft and Flange Mounted Drive design.

TWO RATIOS, 15:1 and 25:1
HORSEPOWER RATINGS TO 125
TORQUE RATINGS TO 100,000 LB-IN.

Ask for **Bulletin 7100.1 (Shaft and Flange Mounted Drives) or for Bulletin 7106.1 (Screw Conveyor Drives).**

THE FALK CORPORATION
MILWAUKEE 1, WISCONSIN

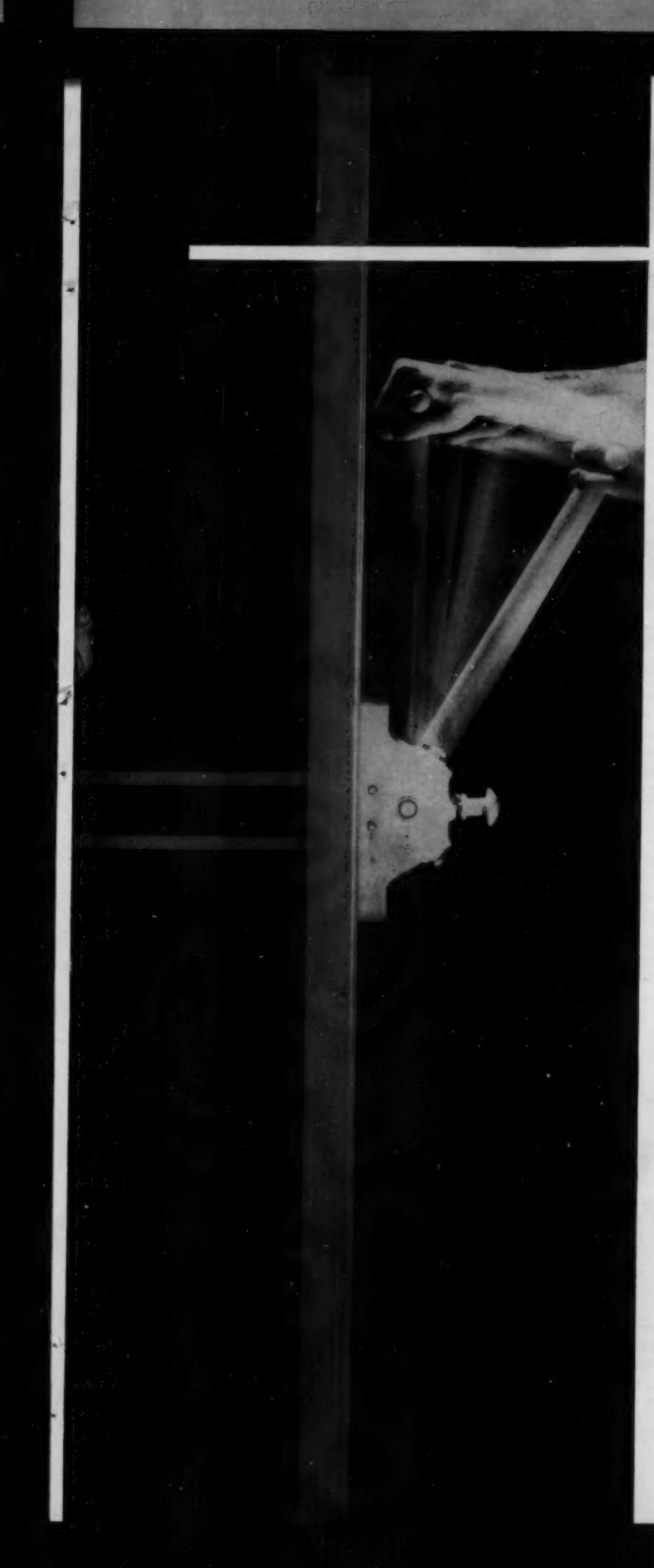
Manufacturers of Quality Gear Drives and Flexible Shaft Couplings

Representatives and Distributors in most principal cities

A POINT TO PONDER...when you need gear drives or shaft couplings of "FALK OR EQUAL" quality, where but from Falk can you get the "OR EQUAL"?

FAULT CLOSING

S&C metalclad switchgear meets all requirements of new National Electric Code for fault closing, short-circuit interruption. Performance proved by high power testing at KEMA laboratories.



S&C metalclad switchgear can close on any fault up to 60,000 amps

No danger to equipment—no danger to operator even if he closes load interrupter switch on the heaviest faults. S&C's new line of metalclad switchgear is rated as high as 40,000 amps fault closing, 500 mva short-circuit interrupting at 14.4 kv. And at 4.16 kv, the corresponding ratings are 60,000 amps, 250 mva!

Here's how it works: 1) Fault never flows through interrupting unit when switch is closed . . . it flows through separate arcing contacts; 2) Arcing is minimized and magnetic forces are overcome by quick-make, quick-break toggle action no matter how slowly operator closes handle.

Short-circuit interrupting duty (up to 500 mva) is handled by a new boric acid power fuse, the Type SM, which features multiple bore construction to handle low, medium, and high faults.

The simplicity of the S&C design—power fuses for short-circuit interruption and load interrupters for manual or automatic load switching—enables you to save as much as 50 percent on your switchgear investment. Why not consider S&C Metalclad Switchgear for your high voltage power systems? In industrial plants and commercial and institutional buildings there are rarely any transient faults, so there is no real need for the automatic reclosing ability of the more expensive circuit breaker type of switchgear.

For more information please consult the telephone directory for your nearest S&C sales office.

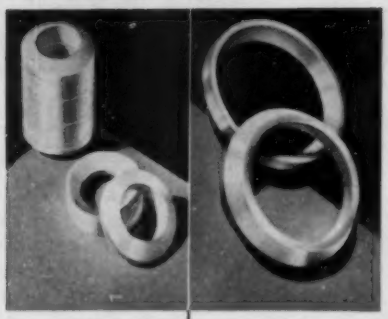
S & C ELECTRIC COMPANY

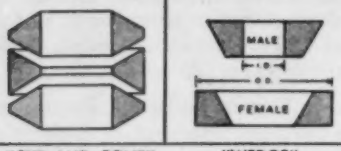
4423 Ravenswood Avenue • Chicago 40, Illinois

Specialists in High Voltage Circuit Interruption since 1910

For more facts circle 519 on Reply Card

NEW CHEMPRO LOW GLAND PRESSURE TFE TEFLON† PACKING SETS





"CUP AND CONE" "WEDGE"

USED FOR VALVES, HEAT EXCHANGERS AND OTHER STATIC AND SEMI-STATIC APPLICATIONS

Chempro Style 300 "Cup & Cone" and Style 305 "Wedge" packing ring sets are two new resilient, low gland pressure packings designed for tight, sure sealing with a minimum gland pressure. Nominal gland pressure causes the rings to slide against each other, exerting pressure both against the stem or rod and the bore.

These packings have all the advantages of Teflon, being completely unaffected by the strongest acids, solvents and alkalies.

COMBINATION SETS AVAILABLE FOR ROTATING SERVICE

Resilient Chempro "Cup & Cone" or "Wedge" rings can be combined with tough, pressure-resisting Chempro Style 101 packing rings to form a rugged combination set ideal for use on a wide range of rotating or reciprocating services.

Write for revised Chempro Bulletin CP-552, giving complete ordering information.

† duPont trademark

CHEMICAL & POWER PRODUCTS, Inc.

7 Broadway, New York 4, N. Y.

For more facts circle 520 on Reply Card

BACKTALK AND FORETHOUGHTS

Edited by Marjorie E. Weissman

Plywood in Plant Construction

PLANT ENGINEERING:

"Your issue of December, 1960 shows on page 134 a very interesting outline of possible uses of plywood in plant construction. Please advise how we could obtain some detailed outline on the application of plywood in office and plant construction use and which cost figures would have to be applied in order to make a comparison with conventional building methods." *G. Bernhardt, P. E., Manager, Engineering Department, Canada Iron Foundries, Ltd., Montreal, Canada.*

■ We have suggested two sources for this information as we do not have any additional material in this office.—*Editors.*

Strike Out Section A

PLANT ENGINEERING:

"Please forward the 16-page copy of Section A, General Conditions, applicable to all contracts, large or small. Also, full size reproductions of the bulletins as shown in your publication, 'If Faced With a Major Construction Project . . .'

"The above mentioned publication has been most enlightening and we look forward to the further information requested." *M. Barkay, Barkay Building Co., Ferndale, Mich.*

■ We have sent Mr. Barkay the material he requested, but are sorry to have to announce that our supply of these reprints is completely exhausted. We regret that we shall not, therefore, be able to fill any more requests for this set of reprints.—*Editors.*

Disposing of Radioactive Waste

PLANT ENGINEERING:

"We found the article 'Radioisotopes Primer' in the November, 1960 issue of PLANT ENGINEERING typical of your usual well written and interesting articles. PLANT ENGINEERING has successfully presented a highly technical subject that can be more easily understood not only by plant engineers but other business men as well.

"Our company, a manufacturer of storage containers, is interested in the disposal of contaminated solid and liquid waste. We suppose that solid wastes might include gloves, rags and other cleaning materials exposed to contaminated areas. Would you be able to tell us where we might obtain additional information pertaining to the different kinds of waste materials and their various methods of disposal?

"Again, thank you for PLANT ENGINEERING's interesting article." *James Paull, Jr., Eagle Manufacturing Co., Wellsburg, Va.*

■ Several sources of information have been sent to Mr. Paull.—*Editors*

Thanks for the Plaudits

PLANT ENGINEERING:

"In reference to the notice you published in the December PLANT ENGINEERING magazine, we would appreciate receiving one of your lighting calculators for the use of our architectural engineering group in planning industrial buildings. I would also like to say that your December issue had the most comprehensive coverage of the multiple phases of industrial construction which I have ever seen in one magazine. I am sure that it will be extremely helpful to all of us who are involved in either plant engineering or industrial construction." *G. E. Shull, Administrative Engineer, Pascoe Steel Corporation, Pomona, Calif.*

PLANT ENGINEERING:

"Please send me the free Sylvania lighting calculator shown in the October, 1960 issue of PLANT ENGINEERING.

"I have been reading PLANT ENGINEERING since I started in engineering as a draftsman about 10 years ago. I have found many times that the articles in your magazine have saved me much time in some of my jobs.

"I hope to be reading PLANT ENGINEERING for many years to come. Thank you for your many excellent articles." *Arthur W. Buck, Senior Design Engineer, Purex Corporation, Ltd., South Gate, Calif.*

Industrial Construction Reprints

PLANT ENGINEERING:

"I would like to take this opportunity of thanking PLANT ENGINEERING for co-sponsoring the October Industrial Lighting Conference. The article in your December issue brought back to mind how helpful the information on lighting design and maintenance was.

"Inasmuch as Mars is now engaged in constructing a large addition to its present facilities, your article 'Indus-

FAR LESS STRESS IN LXS

THE CHAIN WITH NO "STRESS RAISERS"!

Link-Belt LXS brings long-term economy and efficiency to the most punishing drive and conveying jobs. With its "FULL-ROUND" design, LXS has no stress concentration points . . . none of the sharp corners which frequently shorten the life of many ordinary chains.

LXS is available with straight or offset sidebars. For details, contact your nearest Link-Belt office or authorized stock-carrying distributor. (See CHAINS in the yellow pages of your phone book.) Ask for our new, comprehensive Catalog 1050 and LXS Book 2454.

They're all of "FULL-ROUND" design

PINS BUSHINGS SIDEBARS

"FULL-ROUND" design eliminates traditional stress concentration points in Link-Belt LXS . . . provides maximum live bearing area between pins and bushings. Result: stress is distributed evenly.

Other LXS long-life features include controlled press fits plus use of selected steels and controlled hardening of all parts. All this contributes to greater uniformity, greater endurance.

LINK-BELT

CHAINS AND SPROCKETS

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants, Warehouses, District Sales Offices and Stock Carrying Distributors in All Principal Cities. Export Office, New York 7; Australia, Marrickville (Sydney); Brazil, Sao Paulo; Canada, Scarboro (Toronto 13); South Africa, Springs. Representatives Throughout the World.

For more facts circle 521 on Reply Card

MAKE YOUR OWN
HERC-ALLOY
CHAIN ASSEMBLIES
without delay with...

CM
Hammerlok®
COUPLING LINK
• NO PEENING
• NO WELDING

PLUS HERC-ALLOY CHAIN, OBLONG MASTER LINKS AND SLING HOOKS ALL AVAILABLE FROM YOUR CM CHAIN DISTRIBUTOR

COLUMBUS McKINNON CHAIN DIVISION
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Tonawanda, New York
NEW YORK • CHICAGO • CLEVELAND
SAN FRANCISCO
Warehouses: San Francisco, Portland, Los Angeles, Salt Lake City and Dixon, Ill.
In Canada: Columbus McKinnon Limited, St. Catharines, Ontario

CM CHAIN

For more facts circle 522 on Reply Card

BACKTALK—FORETHOUGHTS

trial Construction and the Plant Engineer' is proving to be most timely and helpful in organizing the thinking on the great scope of problems involved. To go into every phase of your magazine would be impossible; I can just say you are doing a great job and I am looking forward with great interest to your future publications." *Fred J. Wernicke, Electrical Engineer, Mars Inc., Chicago, Ill.*

PLANT ENGINEERING:

"The special section 'Industrial Construction and the Plant Engineer,' appearing in your December, 1960 issue, is an extremely usable and instructive group of articles. I would very much appreciate having two reprints." *C. R. Timm, Director of Engineering, Dominion Rubber Company Ltd., Montreal, Canada.*

PLANT ENGINEERING:

"I was very much impressed with your section 'Industrial Construction and the Plant Engineer' in the December, 1960 issue of PLANT ENGINEERING.

"Please send us two reprints of this special section, one for our office library and one for my personal file." *K. M. Johnson, Project Engineer, Marinette Paper Co., Marinette, Wis.*

■ These are but a few of the many letters we have received in praise of the special 48-page section in our December issue, edited by Construction Editor Andy Anderson. Reprints are available free.—*Editors.*

Natural Gas for Flame Cutting

PLANT ENGINEERING:

"I am presently studying the possibility of converting from acetylene to natural gas for our oxy-cutting process. Seeking information on the subject I find that such an article appeared in the July, 1959 issue of PLANT ENGINEERING, written by John Gilroy and R. Fish of the Harnischfeger Corporation.

"Would you kindly send me a reprint of this article and any others which you may have published recently on this subject." *E. J. Zahumensky, Project Engineer, Standard Railway Equip. Div. of Stanray Corp., Hammond, Ind.*

Reprints Available—No Charge

PLANT ENGINEERING:

"I am very much interested in obtaining reprints of two articles which appeared in your January, 1961 issue. The two articles are 'Plant Engineering Report: Maintenance . . . Training . . . Procedures' and 'How Engineering Libraries Can Pinpoint Information.' If these reprints are obtainable, will you please forward two copies of each article to the Physical Plant department at the University of Washington." *G. M. Clayton, Manager, Maintenance and Operations Div., University of Washington, Seattle, Wash.*

Seeks Information on Tool Trucks

PLANT ENGINEERING:

"We are investigating the use of special equipment and tool trucks (equipped with a welder, cutting torch, etc.) by our maintenance personnel and we would appreciate your help. Would you please advise us of any issues of your magazine in which you might have published articles on this subject or, better still, tear sheets of them, if they are still available. Information as to other sources would also help. Thank you very much." *R. P. Crane, Assistant Plant Engineer, Standard Steel Works, Burnham, Pa.*

■ We have sent several tear sheets and reprints to Mr. Crane which we believe will fill the bill. Supplies however, are very low.—*Editors.*

Lighting Calculators Go Astray

PLANT ENGINEERING:

"On December 7, 1960, you advised me that my name had been forwarded to the supplier of the free lighting calculator which was advertised in your magazine, and that I would be receiving this item in the near future.

"To date, I have not received the calculator. I would appreciate it if you would check with the supplier, to ascertain that my name reached their mailing list. Thank you for your kind assistance in this matter." *A. O. Froehlich, Facilities Design Department, International Business Machines Corporation, New York, N.Y.*

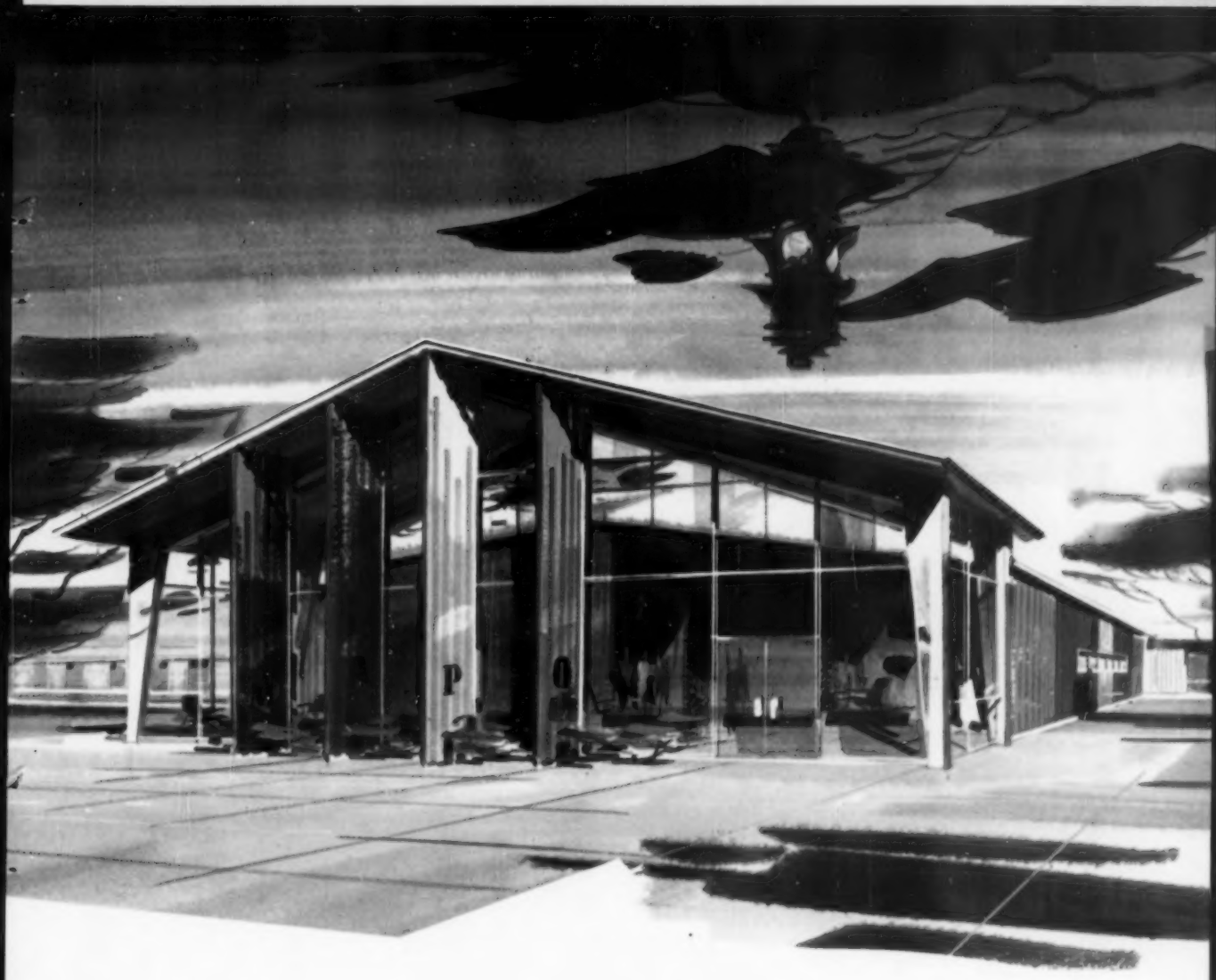
PLANT ENGINEERING:

"It appears that my original request for the lighting calculator has gone astray.

"I would appreciate receiving this calculator." *J. E. Levesque, Plant Engineer, Sandy Hill Iron and Brass Works, Hudson Falls, N.Y.*

■ The supplier of the calculator, Sylvania Lighting Products, Inc., has been deluged with requests and it is not surprising that a few of them have gone astray. Nevertheless, we hope that any reader who asked for a calculator and has not received one after a reasonable interval, will write to us again. —*Editors.*

For more facts circle 523 on Reply Card—►



Handsome is and handsome does

...colorful Butler Buildings are functional too!

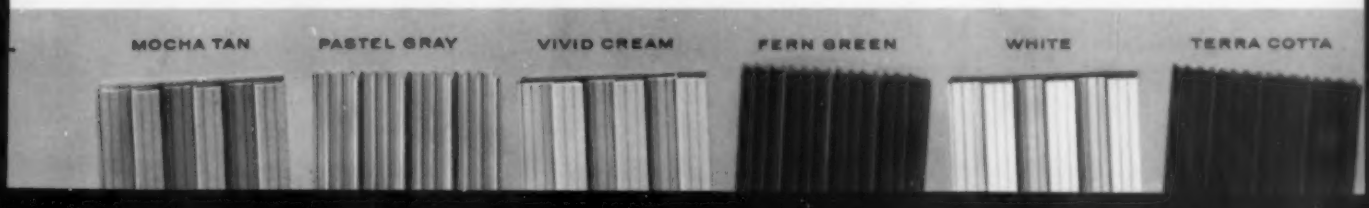
It's no accident that Butler buildings are finished with the most striking *and* protective color offered in the industry – Butler-Tone™. Butler alone uses America's number one system of pre-coating metal panels. Butler-Tone coats both sides. Butler-Tone adds extra years of new-looking color and time-defying protection. Maintenance costs are minimized.

Add Butler-Tone to the industry's two outstanding wall systems, optional roof guarantee, widest range of clear-span sizes and types – and you have America's number one pre-engineered building value.

Phone your Butler Builder for the full story. He's in the Yellow Pages under "Buildings" or "Steel Buildings." Ask about financing, too. Or write direct.

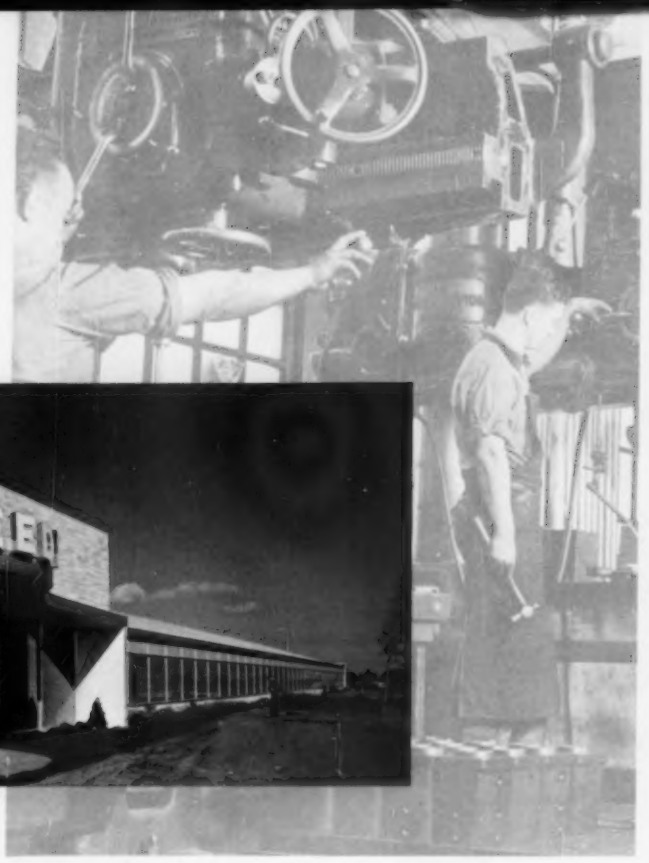
TURN THE PAGE TO SEE WHAT COLORFUL BUTLER BUILDINGS WILL DO FOR YOU...

CELEBRATING 60 YEARS
BUTLER
FABRICATING METALS



Coast to Coast

...industry finds advantages in **BUTLER BUILDINGS**



Flick-Reedy Manufacturing Corporation, Bensenville, Illinois, winner of Factory Magazine's 1960 "Plant of the Year" award. ARCHITECT: *Zay Smith & Associates, La Grange, Ill.,* DESIGNER: *Norman Steenhof.*

Manufacturing . . . warehousing . . . distribution, industry finds that the Butler Building System suits all three functions.

. . . like floor space. Clear-spans bridge areas up to 120 feet.

. . . like overhead space. Rigid frame design provides space for lights, craneways, other fixtures. Raw and finished inventories stack to maximum pallet heights.

. . . like expandability. Adding to a Butler is easy, fast, economical . . . with practically full salvage of original materials.

No, there's nothing nebulous about the advantages our customers associate with Butler industrial buildings. Your Butler Builder (see "Buildings" or "Steel Buildings" in the Yellow Pages) will be happy to discuss other advantages, including financing. Call him . . . or write direct.

Southwestern Plastics, Houston, Texas

"See Sweet's Industrial or Architectural File—Section 8-B"

MBMA

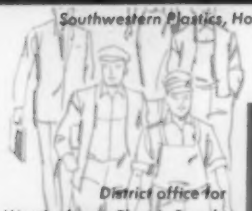
BUTLER

BUTLER MANUFACTURING COMPANY

7375 EAST 13th STREET, KANSAS CITY 26, MISSOURI

Manufacturers of Metal Buildings • Plastic Panels • Equipment for Farming, Transportation, Bulk Storage, Outdoor Advertising • Contract Manufacturing

Sales offices in Los Angeles and Richmond, Calif. • Houston, Tex. • Birmingham, Ala. • Kansas City, Mo. • Minneapolis, Minn. • Chicago, Ill. • Detroit, Mich. • Cleveland, Ohio • New York City and Syracuse, N. Y. • Washington, D. C. • Burlington, Ontario, Canada



District office for Westinghouse Electric Supply Company, Worcester, Mass., one of six Butler buildings recently completed for The Westinghouse Electric Supply Company throughout the country.

How to buy panelboard trouble

The circuit breaker is the heart of a panelboard. Trouble just stands and waits for the buyer who ignores the importance of the breaker. Here's how most panelboard builders guard against it. They use I-T-E circuit breakers in preference to any other make. Reason: Superior design and construction pay off in better protection. Yet I-T-E costs no more.

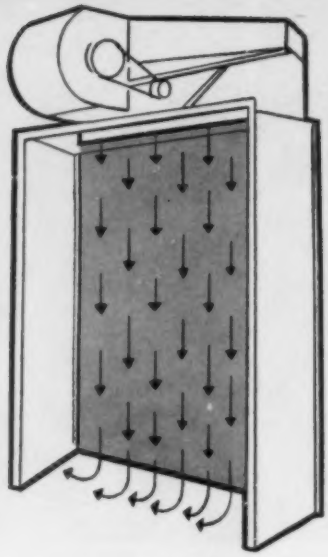
Write for the new bulletin on I-T-E molded case circuit breakers. I-T-E Circuit Breaker Company, Dept. SA, 1900 Hamilton St., Philadelphia 30, Pa.

I-T-E CIRCUIT BREAKER COMPANY

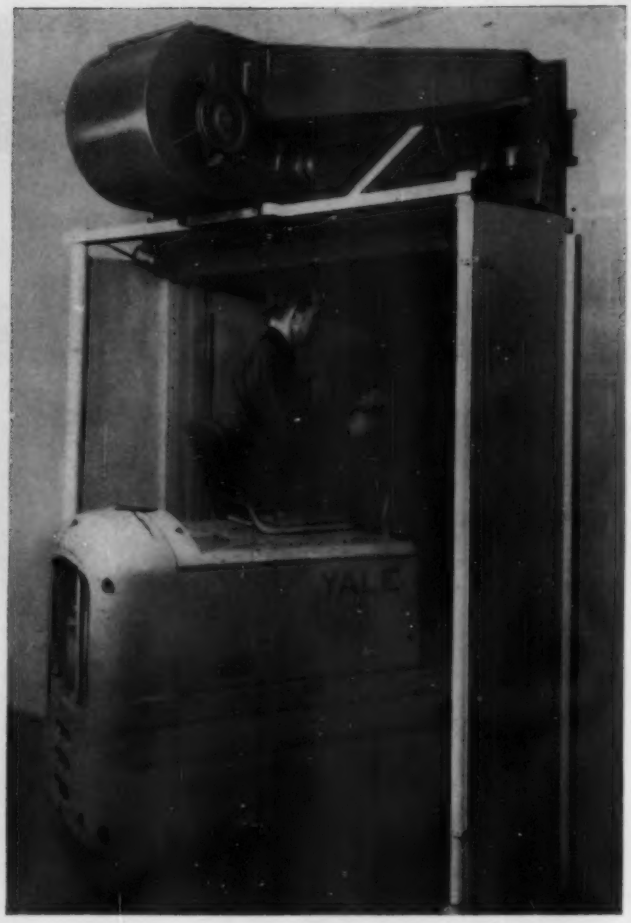
For more facts circle 524 on Reply Card

AIR ISOLATOR*

***opens** doorways to unlimited traffic*



Air Isolator is available for openings up to 8′ wide, 10′ high.



Traffic speeds through "open" door as Air Isolator immobilizes movement of air between the two areas.

***screens out** heat, cold, humidity, dust, odors, insects*

• AIR ISOLATOR is the proven and practical answer to high volume traffic problems between two areas of different temperature or humidity.

AIR ISOLATOR provides a high velocity curtain of vertical air across open doorways to form a shield between outside and inside air. During periods of heavy traffic, doors can be opened and left open. Traffic moves faster; dust, cold, heat, odors or insects are repelled; worker comfort is assured.

* registered trademark and product of Lehigh, Inc.

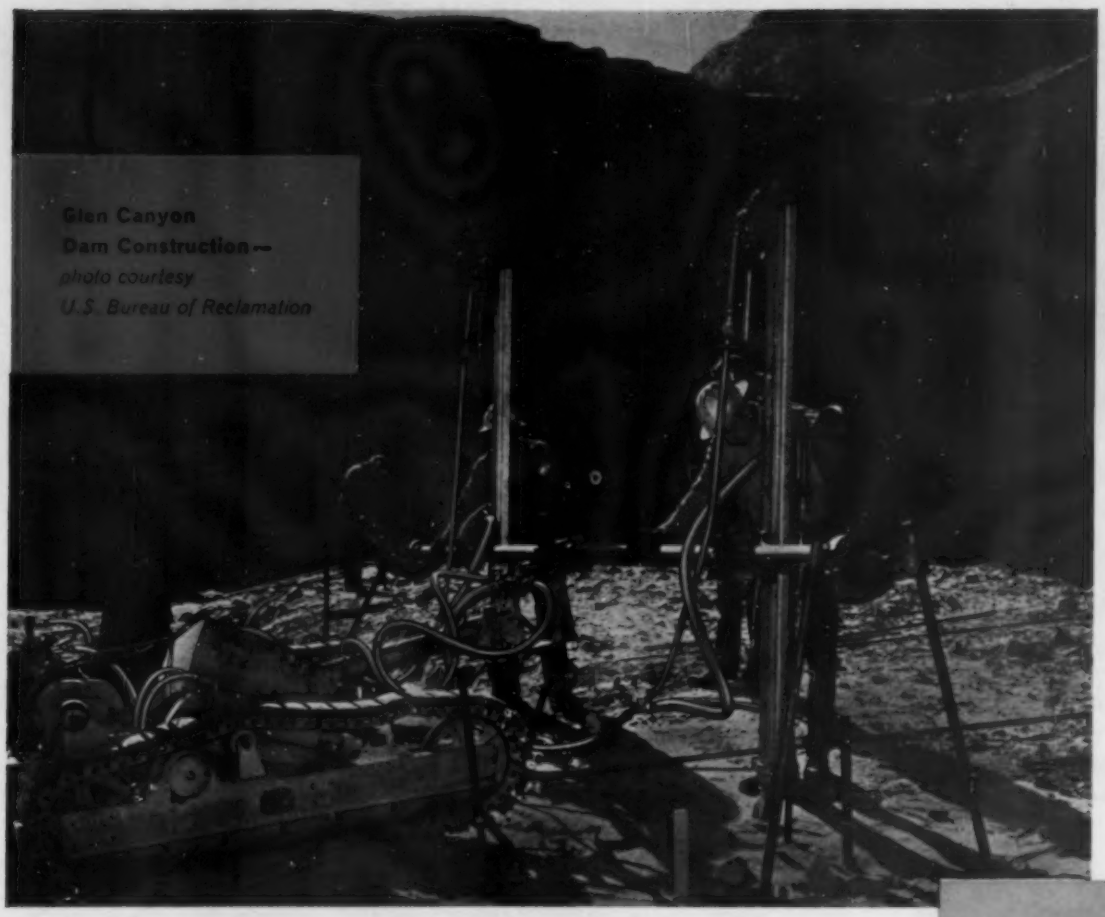
WRITE FOR INFORMATION

Complete data on the economical Air Isolator is yours for the asking. Write today to Jamison Cold Storage Door Co., Hagerstown, Md.

JAMISON

COLD STORAGE DOORS

For more facts circle 525 on Reply Card



Glen Canyon Dam Construction—
photo courtesy U.S. Bureau of Reclamation

Gates Hose moves mountains... keeps production going in industrial plants

Wherever hose is used, on construction projects or in industrial plants, you find Gates Hose giving outstanding service. Gates makes a hose for every industrial application—air hose, water hose, steam hose, suction hose—every type of industrial hose in a full range of sizes. All are dependable, top-quality products of Gates continuing program of *Specialized* Research.

You get fast delivery from local stocks. The hundreds of Gates Distributors, located in all parts of the country and throughout the world, have large stocks of hose on hand, backed by Gates servicing warehouses in every major industrial center.

This means that you always get quick delivery of Gates Industrial Hose from a local source.

Call your nearby Gates Distributor when you need hose of any kind, for any purpose.

The Gates Rubber Company, Denver, Colorado BP 21A

GATES 18HB PREMIUM QUALITY AIR DRILL HOSE

Is used on most major construction projects. Highly resistant to abrasion, it is also flexible and easy to handle. It gives exceptional performance and long service on all light and heavy duty air drill applications under the most severe conditions.

A Gates Hose for any industrial need is quickly available from your nearby Gates Distributor.
Building the future on 30 years of progress
Gates

Gates Industrial Hose

For more facts circle 526 on Reply Card

DODGE HAS MORE PROVED BEARINGS THAN YOU HAVE BEARING PROBLEMS!

It pays to buy from a line of stock bearings—bearings that have been proved in thousands of installations similar to yours. You benefit by getting known dependability; and you get the important savings of high quality at production price.

PIN-POINT SELECTIVITY

Dodge has supplied mounted bearings to industry for over three-quarters of a century. Dodge bearings have always kept pace with improved production practices. Each new condition of service has been met by Dodge as it has arisen, with the result that the Dodge line contains mounted bearings to meet almost every service requirement with pinpoint accuracy.

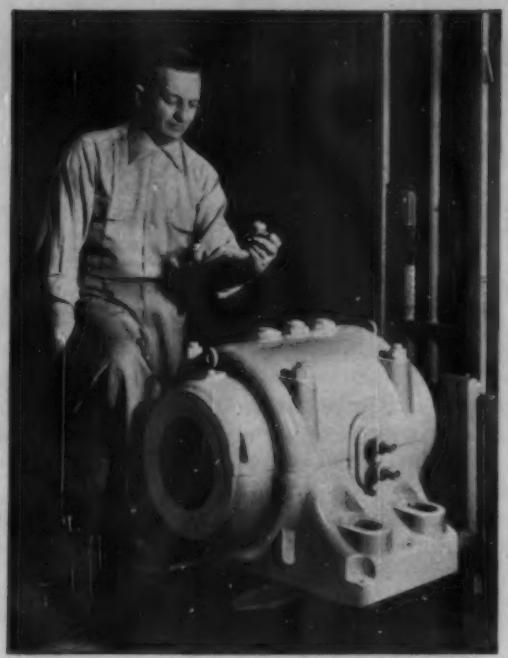
High load, high speed, excessive dust, moisture, corrosion, high or low temperatures, continuous operation—you name it!—such conditions and their combinations are met every day with Dodge bearings.

BROAD LINE—WIDELY DISTRIBUTED

In the great variety of mounted bearings developed by Dodge, you will most likely find the precise unit to fit your requirements ideally—without paying for features you do not need. And if your requirements call for several types of bearings, there is an advantage in having them of common design, such as Dodge offers.

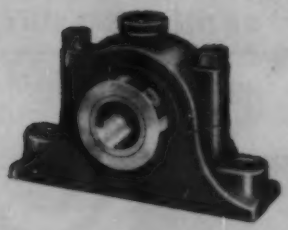
The Dodge line is probably broader than any other line of mounted bearings in America. And of special importance to machinery manufacturers, it is the most widely distributed line. There is always a Dodge bearing of the right type and size near at hand.

You can check this with your local Dodge Distributor. Ask him—or write us for the Dodge Bearing Bulletin.



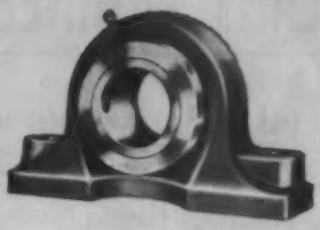
In addition to tapered roller, spherical roller and ball bearings, Dodge builds many types of sleeve bearings. Here is the "large and small" of the sleeve type bearings carried in stock—ranging from an 8-in. Sleevoil weighing over 1200 lbs. to a ½-in. solid journal bearing weighing 9 ounces.

DODGE MANUFACTURING CORPORATION, 2700 Union Street, Mishawaka, Indiana

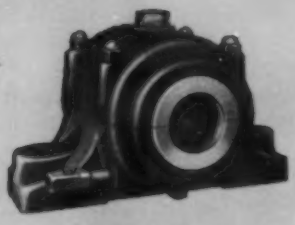


DODGE PILLOW BLOCKS WITH TIMKEN TAPERED ROLLER BEARINGS

DODGE SPHER-ALIGN PILLOW BLOCKS WITH SPHERICAL ROLLER BEARINGS



DODGE BALL BEARING PILLOW BLOCKS



DODGE SLEEVOIL PILLOW BLOCKS

DODGE BRONZOIL PILLOW BLOCKS

DODGE BRONZE BUSHED PILLOW BLOCKS

DODGE JOURNAL BEARINGS SOLID AND SPLIT

DODGE HEAVY RIGID PILLOW BLOCKS

FLANGE BEARINGS: HANGER BEARINGS: BEARING UNITS: TAKE-UPS

● **Dodge Pillow Blocks with Timken Tapered Roller Bearings.** America's quality pillow blocks. Assembled, lubricated, adjusted and sealed at the factory. 5 types for varying needs.

● **Dodge Spher-Align with Spherical Roller Bearings.** Rugged heavy duty, compact, inherently self-aligning. Exclusive Micro-Mount simplifies installation.

● **Dodge Ball Bearing Pillow Blocks.** Deep groove ball bearings with long inner races—high capacity. SL, SC and SCM models for light, normal and medium service respectively.

● **Dodge Sleevoil Pillow Blocks.** Ultra quality . . . extra long life . . . accessibility . . . *quiet*. Plain or water-cooled.

● **Dodge Bronzoil Pillow Blocks.** Efficient, low cost pillow blocks with self-oiling, capillary bronze bushings. Self-aligning. Large oil reservoirs.

● **Dodge Bronze Bushed Pillow Blocks.** Quiet fan and blower pillow blocks with two bronze bushings of high lead content mounted in one cast iron housing.

● **Dodge Journal Bearings — Solid and Split.** True running, dependable. Babbitted bearings with precision machined bores and faces. Finished bases.

● **Dodge Heavy Rigid Pillow Blocks.** Rugged, carefully bored, babbitted pillow blocks for many applications requiring grease lubrication. Finished bases and ends.

● **Bearing Units.** A wide variety—spherical seat, cartridge, flange, hanger, screw conveyor hanger, take-up. Ball, Roller and Sleeve types.

CALL THE TRANSMISSIONEER—your local Dodge Distributor. Factory trained by Dodge, he can give you valuable help on new, cost-saving methods. Look under "Dodge Transmissioneer" in the *white* pages of your telephone directory, or in the yellow pages under "Power Transmission Machinery."

DODGE

of Mishawaka, Ind.

For more facts circle 527 on Reply Card

PLANT ENGINEERS' DIGEST—so those who rush may read and know what's new

Edited by Marjorie E. Weissman

Dial-Your-Own Spot Heat Keeps Machine Operators Warm in Cold Area

EMPLOYEES WORKING in the semi-open packaging department of the U.S. Gypsum Co. plant at Oakfield, N.Y., manage to keep warm and comfortable despite winter weather. The reason is the spot heating system which allows the machine operators to control their own comfort by turning a dial.

The packaging machines are located in an unheated section of the plant next to the doors of the loading dock and it is necessary that the doors be open most of the time, all year around, to expedite loading and shipping of products.

The dials operate an electric, metal sheath, infrared comfort heating system installed at each of three machines. Each system consists of four 3000-watt infrared heaters, two 1800-watt heaters, an input controller and a magnetic contactor. Two of the larger units are mounted together nine feet above the control area of the machines and two are located at the same height, but angled inward over the hand truck positions immediately behind the operators.

Heaters, arrows, keep operators in semi-open areas warm in coldest weather.

The smaller heaters are each mounted vertically at an angle on either side of the machines facing across the bag loading positions.

To operate the heaters, the dial on the input controller is turned to a maximum setting for fast warmup, then is cut back to 20 to 45 per cent setting. On extremely cold days, the control setting may be in the range of 30 to 45 per cent all day. If the operator leaves the heated area, he can raise the heat when he returns to get fast warmth in three to five minutes. *From a release of Edwin L. Wiegand Co., Pittsburgh, Pa.*

Mineral Tile as Air Diffuser

THE AIR CONDITIONING plan for our four story, 220,000 sq-ft structure incorporates the use of perforated mineral tile suspended ceilings for the dual purpose of acoustical treatment and air diffusion.

Air conditioning system incorporates perforated mineral acoustical tile as air diffusers throughout the building.

The system was made possible by drilling small holes through mineral acoustical materials to allow air to enter a room at equal pressure and temperature through the openings in the ceiling surface.

Intended mainly as an experiment to test the efficiency of perforated mineral tile ceilings as air diffusers, the system proved highly economical to install. Besides providing acoustical treatment and improved air circulation, it saved the company thousands of dollars by eliminating standard diffusers, and a considerable amount of duct work. Only a duct stub was required in each room to discharge the conditioned air into the plenum space above the suspended ceiling.

The concept of using the plenum as a pressure chamber for conditioned air is not new nor is the idea of diffusing air through the ceiling, but the employment of standard, perforated mineral tile ceilings as air diffusers, is new. The holes in the tile are not noticeable, since they fit in with the over-all design pattern of the ceiling and effectively eliminate noise, drafts and cold spots.

The new system also made it possible to lower the ceilings in most areas of the building, providing a more attractive appearance. The original plaster ceilings were approximately 12 to 18 in. higher than the present ceiling level.

Air is recirculated with 25 per cent new air added. The air is discharged into the rooms where individual room thermostats are located. The thermostat regulates a booster heater coil in the stub duct to provide individual

(Continued on page 42)

CROUSE/HINDS

WJB and WJBF Series

JUNCTION CONDULETS®

NOW AVAILABLE IN 28 DIFFERENT SIZES...

Heavy-duty junction boxes have to be more than mere splice points. That's why the Crouse-Hinds WJBF floor-Condulet is built to resist wash-down water, atmospheric moisture, dust and alkaline atmospheres — conditions that will reduce an ordinary junction to fireworks long before the Fourth of July. Hot-dip galvanized, cast Feraloy construction does the job.

And you can get the same neoprene-gasketed moisture protection in the surface-mounted raintight Crouse-Hinds WJB Condulet. Both types are available in cast aluminum, sold at the same price as Feraloy.

28 sizes of each type are available, ranging from 4"x4"x4" to 24"x24"x12", with or without mounting feet. The number and size of conduit entrances can be specified or Condulets can be drilled and tapped in the field. *For more information check your Crouse-Hinds Distributor.*

CROUSE HINDS
SYRACUSE NEW YORK

OFFICES: Atlanta Baton Rouge Birmingham Boston Buffalo Charlotte Chicago Cincinnati Cleveland Corpus Christi Dallas Denver Detroit Houston Indianapolis Kansas City Los Angeles Milwaukee New Orleans New York Omaha Philadelphia Pittsburgh Portland, Ore. St. Louis St. Paul Salt Lake City San Francisco Seattle Tulsa Washington

RESIDENT REPRESENTATIVES: Albany Baltimore Reading, Pa. Richmond, Va.

Crouse-Hinds of Canada, Ltd., Toronto, Ont. Crouse-Hinds-Domex, S. A. de C. V. Mexico City, D. F. Peterco, Sao Paulo, Brazil

For more facts circle 528 on Reply Card

PLANT ENGINEERS' DIGEST

(Digest begins on page 40)

room temperature control. The cool air leaves the central cooling system at 58 F and is warmed to the desired temperature by the booster heater before it passes downwards through the ceiling.

The hot water heating system used in the building for many years was left intact to provide supplemental heat in the winter. The booster heater coils in the air conditioning system provide enough heat that the hot water system need not be used until the outside temperature drops below 40 F.

"Total" winter heating is also possible with this type of system. *From a release of Armstrong Cork Company, Lancaster, Pa.*

Easy-Access Floating Floor

NEED FOR INSTANT access to wires and cables in computor and data processing rooms was solved at the First National City Bank, New York City, by a system of "floating floors" raised above the subflooring on pedestals.

Suction cup removes panels of floating floor to give access to equipment.

The floor consists of a series of 18¼-in. square die cast aluminum plates, interlocked with, and resting on, cast aluminum pedestals with steel footings. These in turn are bonded to the sub-floor with an adhesive designed for the job.

The face of each aluminum plate is covered by an 18-in. square vinyl tile surrounded by a metal or plastic lip or joint the same height as the tile. The plates are instantly removable with a suction cup tool, so that inspection or repairs to the equipment below may be made at any time without ripping up the floor. *From a release of Miracle Adhesives Corp., Bellmore, L.I., N.Y.*

Soldering Iron for Delicate Job

MIDGET soldering irons have helped reduce the reject rate for inspected electronic circuit assemblies at Hughes Aircraft Company, El Segundo Division, Calif.

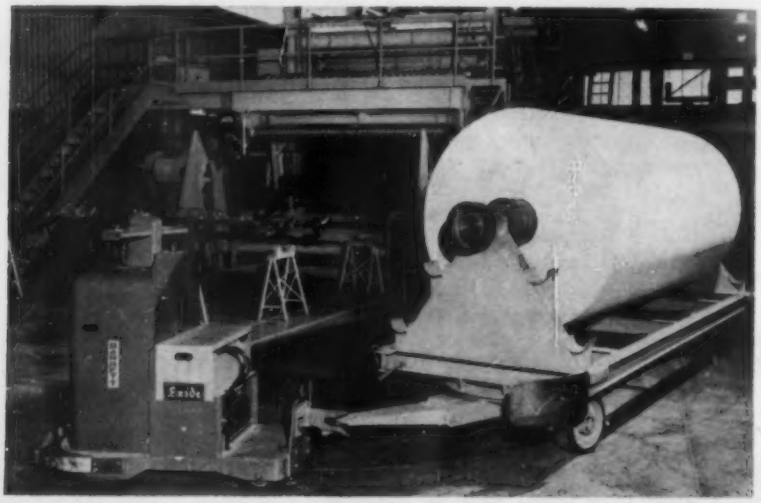
Each work station where the midget soldering irons are used is equipped with its own transformer, mounted underneath the workbench. The iron is connected with about five feet of cord to permit free movement by the operator to any point within the general area of the station.

Small size makes it easy for the operators to use these irons in close

(Continued on page 44)

Driverless Tractor Keeps Rolls of Paper Stock on the Move

A PAPER STOCK handling problem was created for the Blandin Paper Co., Grand Rapids, Minnesota, when a new coating machine was installed on a mezzanine floor. Rolls of paper stock 18 ft long, weighing 12,000 lb each, had to be lifted by overhead hoist from the processing floor below, then moved to the coating machine. To transport the loads once they were on the upper level, the company installed a system using a driverless industrial tractor to tow a trailer on which the paper rolls could be placed.



Specially-equipped driverless tractor hauls rolls from hoist to coating machine.

The overhead hoist can now lift its 12,000 lb roll to the mezzanine and accurately position it directly onto a specially built trailer. The trailer is towed by a specially equipped tractor along a 200 ft guided route directly to the paper coating machine. The tractor stops automatically at an exact position on each trip so that the paper is ready to be fed into the coating machine.

After the paper roll has been removed from the trailer, a button is pressed on the steering column of the tractor to return it to the starting place on the mezzanine for delivery of another load. The tractor automatically stops in the precise position for the hoist to place another paper roll on the trailer. Total round trip distance traveled over the route is 400 ft, without a driver.

Besides carrying the rolls of paper stock to the coating machine, the trailer can also carry a return load of five empty paper core spools. These empty spools which weigh 1500 lb each, are placed on the support bearings mounted along the ends of the trailer. *From a release of Barrett-Cravens Company, Northbrook, Ill.*

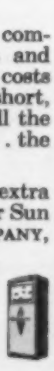
In goes Solnus . . . out goes compressor trouble

By using a Sun Solnus oil, this man is eliminating dangerous carbon build-up—the chief enemy of compressors and the cause of most maintenance shutdowns.

Solnus oils have proved to be ideal compressor lubricants. They form very little carbon . . . and what does form is a soft and fluffy kind that blows away easily from valves and exhaust parts. Because carbon does not build up, ring grooves and air lines stay clean.

With freedom from carbon build-up, operators are assured of peak compressor efficiency for months and sometimes years. Maintenance costs go down and stay down. In short, with Sun Solnus oils you get all the special benefits of quality . . . the best economy of all!

For the full story about the extra benefits of Solnus oils, see your Sun man, or write to SUN OIL COMPANY, Philadelphia 3, Pa. Dept. PY-3. In Canada: Sun Oil Company Limited, Toronto and Montreal.



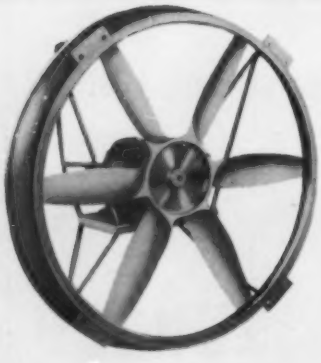
SUNOCO

MAKERS OF FAMOUS CUSTOM-BLENDED BLUE SUNOCO GASOLINES

Standardize on

HARTZELL PROPELLER FANS

for low cost, high efficiency industrial ventilation



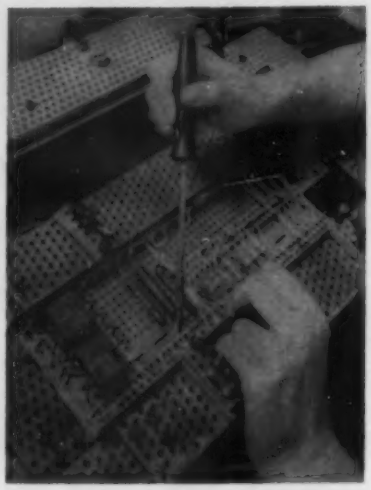
All Hartzell fans are designed and built specifically for the punishing demands of heavy industrial service. All feature cast aluminum alloy propellers and the exclusive Hartzell curved orifice Air Seal ring which eliminates turbulence and backflow of air at the propeller tips. Standard propellers in sizes from 12" to 60" plus special Lo-Noise, high pressure and reversible propellers. All can be furnished in standard direct-connected, ring-mounted models, in panel or duct section mountings, or in special belt-drive, pulley-drive or extension-shaft construction.

Hartzell PROPELLER FAN COMPANY
Division of Castle Hills Corp. • PIQUA, OHIO

For more facts circle 530 on Reply Card

PLANT ENGINEERS' DIGEST

(Digest begins on page 40)



Use of slender soldering iron on electronic circuits has reduced reject rate.

quarters, reaching all soldering points in the most intricate wiring assemblies. Some of these have soldered joints separated by less than 1/8 in. of space, making precision soldering a necessity.

Three standard interchangeable tips can be used in addition to a 1/8-in. pyramid tip. Renewal tips are installed by unscrewing the used tip from the threaded socket in the iron's handle and replacing it with a new one.

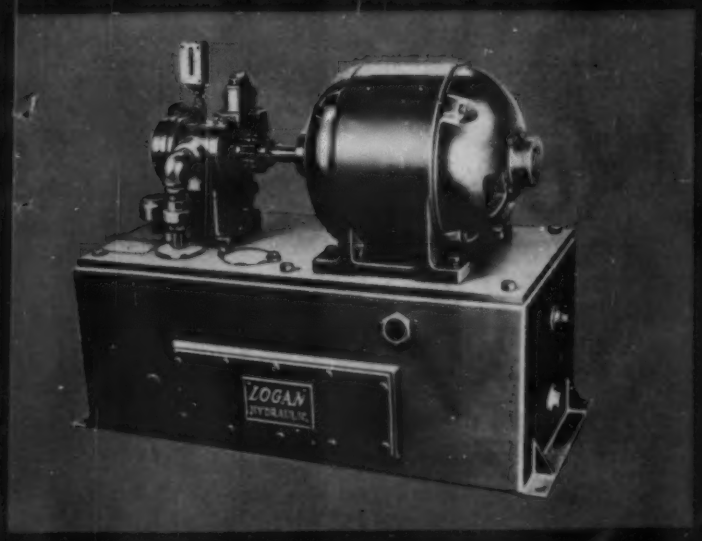
Very little maintenance is required on the irons. In time, tips become oxidized and worn away and even may flake or chip off, but they are relatively inexpensive to replace. *From a release of General Electric Co., Schenectady, N.Y.*

Easy Handling of Iron Ore

IRON ORE is now being transported from storage to stock house by air-operated side-dump railroad cars at our steel mill.

Ore was formerly transported by hopper cars. Walkways or plates approximately two feet wide had to be located by the crane over the scrap bins on each side of the hopper car. After the hoppers were opened, a crane-operated car shaker was used to finish emptying the car. This was a noisy and time-consuming operation.

With the use of side-dump cars, the dumping operation is more efficient



this power plant packs a Sunday Punch ...EVERY DAY IN THE YEAR!

This husky self-contained power unit combines true economy with tremendous efficiency to power cylinders, chucks, clamping devices and many other hydraulic machines.

Teamed up with Logan's "Super-matic" cylinder, this unit can generate thousands of pounds of pressure and maintain a steady, trouble-free operation month after month—at top production speeds. If you would like additional information about this compact power unit, or any of Logan's other products, just fill in and mail the coupon below.

LOGAN
AIR AND HYDRAULIC OPERATED MACHINES

Check the items you want, fill in your name and address, tear out and mail to:

Logansport Machine Co., Inc. • 760 Center Avenue, Logansport, Indiana

___100-1 AIR CYLINDERS
___100-2 MILL-TYPE AIR CYLS.
___100-3 AIR-DRAULIC CYLS.
___100-4 AIR VALVES
___100-5 LOGANSQUARE CYLS.
___100-6 ULTRAMATION CYLS.
___100-7 SUB-PLATE AIR VALVE
___300-1 CHUCKS
___300-2 PRESSES
___200-1 HYD. POWER UNITS
___200-2 ROTOCAST HYD. CYLS.
___200-3 750 SERIES HYD. CYLS.
___200-4 and 200-7 HYD. VALVES
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___ABC BOOKLET
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___CALCULATOR
___FACTS OF LIFE

Please send copy of catalog

NAME.....

TITLE.....

COMPANY.....

ADDRESS.....

For more facts circle 531 on Reply Card

NEW!
FACTS YOU NEED TO KNOW

about photoelectric controls

Here, in a compact, idea-sparking handbook, is proof that photoelectric controls *can* work — reliably, without fussy engineering, and at long range. They're being used profitably *now*, for machine control, door automation, area surveillance, conveyor control, materials handling, remote control of liquid levels, and countless other applications.

Forty case histories show you graphically how others use Infrabeam to solve tough problems like these:

- Protecting a 1,000 foot fence
- Checking the level of violently rippling liquids
- Preventing damage to machines and operators
- Avoiding wasteful process operation
- Automatically controlling a distribution conveyor

Infrabeam is a totally new type of photoelectric control. It uses *infrared* radiation, *not* visible light, for superior reliability at long range and under difficult light conditions. The beam is *modulated*, to prevent actuation by strong sunlight or incandescent lamps.

It's easy to install and use, too — reliably solves control problems where limit switches, pilot relays and other electromechanical devices are unsatisfactory.

Get the facts. Write for your free copy of "Successful Solutions to 40 Control Problems".

ELECTRONICS DIVISION
CRAMER CONTROLS CORPORATION
CENTERBROOK, CONNECTICUT

Infrabeam *the practical man's photoelectric control*

For more facts circle 532 on Reply Card

PLANT ENGINEERS' DIGEST

(Digest begins on page 40)

Air-operated side-dump cars transport iron ore, make dumping operation efficient and safe for personnel.

and the preparation for dumping is much simpler. Air lines are attached, valves operated, and the car is dumped.

The problem of "frozen" hopper cars which required extra labor to loosen the ore has been solved. Personnel no longer have to walk over rails, bins or beside cars for unloading purposes. *From a release of Timken Roller Bearing Co., Canton, Ohio.*

Recalibrating Storage Tank Volume

A METHOD for recalibrating tanks by metering them has been used by Shell Oil Co. for bulk liquid loss control. Adaptable to liquid handling and processing in all industries, the system employs a mobile unit built around calibrated meters and a simple but flexible valving arrangement.

The meter calibration unit consists of two steel-skid-mounted packages, both, in turn, mounted on a flat bed truck. One package is the power unit, the other consists of the meters, valves and piping.

Standard preliminary procedure calls for the establishment of the calibration factors for each meter based on rate of flow, temperature and specific gravity. These coefficients are verified by means of a meter "prover" before the unit is used.

The liquid to be used for calibrating is circulated within the unit for a sufficient time to bring the meters and parts to approximate operating temperature and particularly to purge the equipment of air pockets and vapors. Care must be taken to eliminate excessive splashing.

If there is a difference between the

Roof ventilator efficiency went up by precisely matching a direct drive motor to fan in these new CRD models. Use?... wherever air needs to be exhausted efficiently, quietly, and inexpensively. A highly efficient backwardly inclined blade design maximizes air flow, and careful rubber mounting hushes motor for maximum quietness. Frame, wheel, hood and housing are of maintenance-free aluminum. Capacities from 194 to 2796 cfm. Write for Bulletin 4104. American-Standard Industrial Division, Detroit 32, Michigan. In Canada: American-Standard Products (Canada) Ltd., Toronto.

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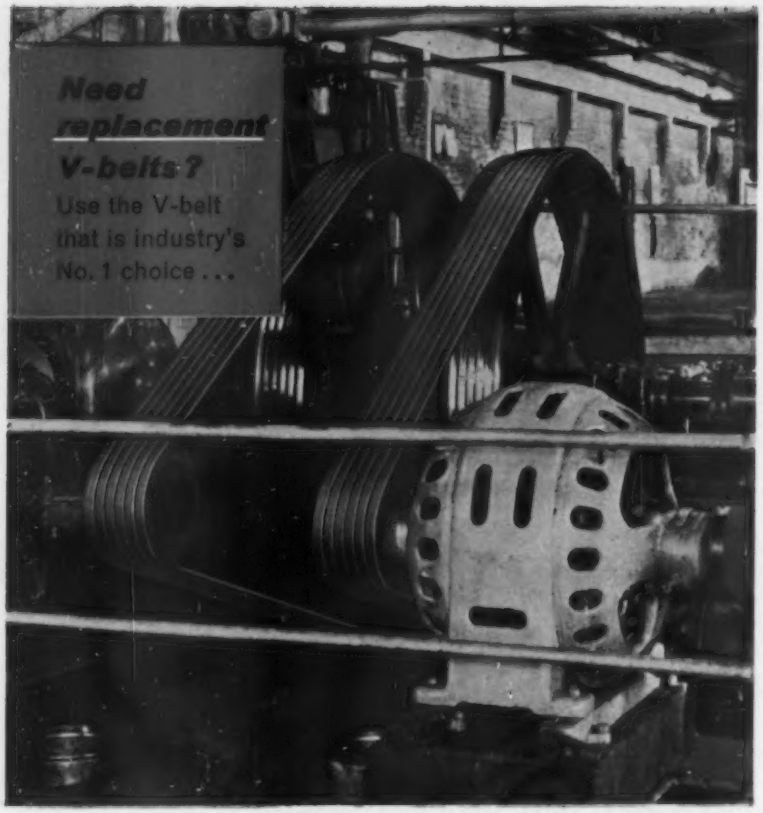
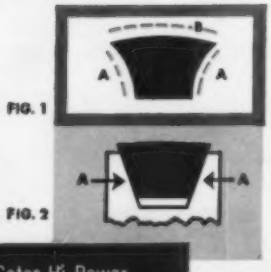


Gates Hi-Power V-Belts give you longer service life on your drives

Concave sidewalls (U.S. Pat. No. 1813698)—It is easy to see why Gates Hi-Power V-Belts give far longer belt life than ordinary V-belts. *Just make this simple test:* Bend a Gates V-Belt as if it were going around a sheave. Feel how the concave sides (Fig. 1-A) *fill out* . . . become perfectly straight (Fig. 2-A) to make *full contact* with the sides of a sheave. The belt thus grips the sheave evenly, and distributes wear uniformly across the sides of the belt, lengthening belt life.

Precisely-engineered arched top—The arched top (Fig. 1-B) of the Gates Hi-Power V-Belt prevents any distortion of the tensile section cords as the belt bends around the sheave . . . the load is uniformly distributed with each cord carrying its full share.

You will get fast delivery of Hi-Power V-Belts from the local stock of your nearby Gates Distributor. Call him today.



The Gates Rubber Company
Denver, Colorado

BP-6

Gates Hi-Power V-Belts

For more facts circle 534 on Reply Card

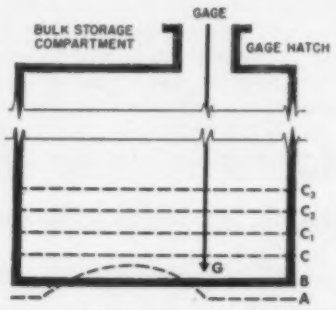
PLANT ENGINEERS' DIGEST

(Digest begins on page 40)

temperature of the product as shown at the thermometer wells of the calibration unit and at the vessel, the metered quantity must be adjusted by the application of temperature correction. This is based on the difference in the two temperatures multiplied by the coefficient of expansion of the product added to or subtracted from the base of 1.0000.

In the diagram, B represents the presupposed base of tank or compartment. From visual inspection, evidence of bottom flexure is represented by A. Line C represents the point at which coverage of the bottom is complete. Point G represents the 0′0″ gage established in the tank gage table.

When these coordinates are established, pumping is started until, by visual inspection, sufficient product has been introduced into the vessel so that point G is awash. Meter filling is stopped, the meter readings are taken and the liquid quantity temperature adjustment between meter and vessel is made. This is noted as the 0′0″ tank gage.



Meter readings taken at designated points show effects of dents and bottom flexing on gage readings in tank.

Pumping is then continued until line C is reached. From there lines C1, C2, C3, etc., are established until all bottom flexing due to liquid head variations ceases, or until structural irregularities have been submerged. After each increment, the meter filling is stopped, and the reading and corrections are made as outlined.

If a new gage table is to be made, the metered quantity is established as the 0′0″ gage. All quantity data on the new table from 0′0″ up to line C liquid level should be based

on the meter filling data. Quantities above this point may be based on gage table increments or new strappings. *From a release of Rockwell Manufacturing Co., Pittsburgh, Pa.*

Remove Silt From Cooling Water

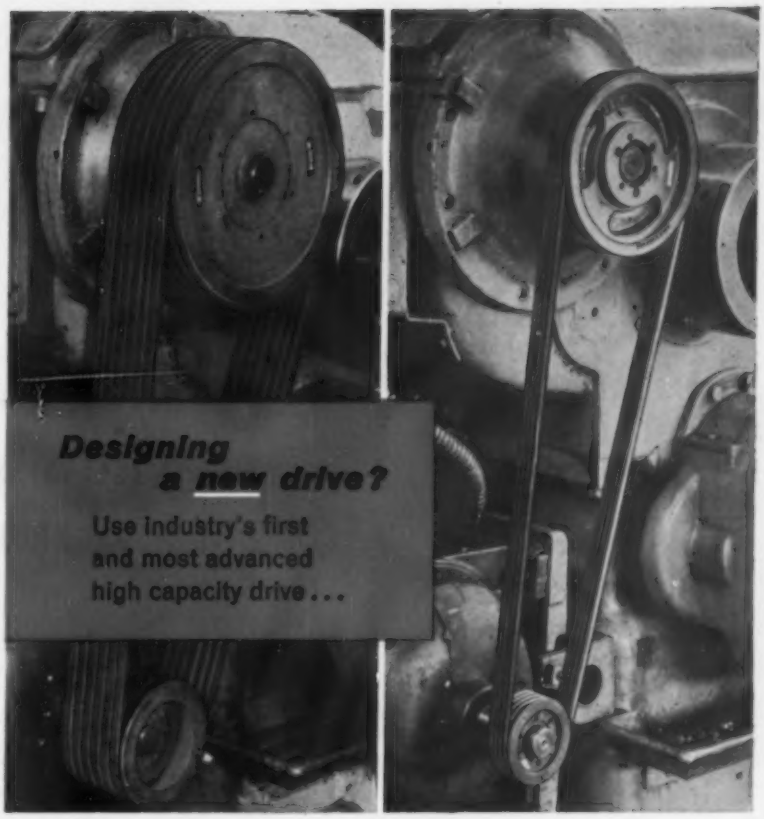
INSTALLATION OF a gravity filter at the Phillips Chemical Company plant at Etter, Tex., reduced the amount of silt in cooling water to a negligible point, thus improving operations and ease of maintenance.

The silting problem was caused by frequent, large quantities of dust in the atmosphere which entered the open recirculating water cooling system and was deposited in piping and heat exchange equipment. This in turn also promoted biological fouling and corrosion. The result of all these conditions was poor heat transfer and high maintenance costs.

An automatic, valveless, gravity filter through which was bypassed approximately one per cent of the total flow of water circulating through the tower, solved the silt problem. During the first week of operation concentration of suspended matter in the circulating water dropped from 2.0 ppm to 0.5 ppm.

The filter system operates without the need of any coagulants to precipitate suspended matter. The installation is 15 ft in diameter and approximately the same height. The tank is divided into three sections. Starting from the bottom, there are the collector chamber, filter chamber, and the backwash storage area. There are no instruments, valves or pumps. *From a release of The Permutit Company, Div. of Pfaudler Permutit Inc., New York, N. Y.*

Gravity filter reduced amount of silt in recirculating cooling water system.

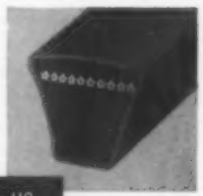


Gates Super High Capacity V-Belts save drive space, weight, money

If you are designing a new drive, or if the belts and sheaves of a conventional V-belt drive must be replaced, you will benefit many ways by installing a Gates Super HC High Capacity V-Belt Drive.

Gates Super HC V-Belt unites new, high performance materials with a basic change in the shape of the belt itself. Because of this, it is able to handle up to 3 times the horsepower of a conventional V-belt in the same space. As a result, Gates Super HC Drives can often cut in half the space required for your drive. Drive costs are cut as much as 20%, and drive weight reduced 20% and more. Guards can be smaller. Bearing loads are less, increasing bearing life. And the drive can operate at belt speeds up to 6000 ft/min without dynamic balancing!

There is a Gates Field Engineer serving your area. To contact him for help in designing a new drive, call your nearby Gates Distributor.



Exclusive design features include: precisely engineered arched top, concave sidewalls, Flex-Weave cover, super strength tensile construction.

Gates

Building the future on 50 years of progress

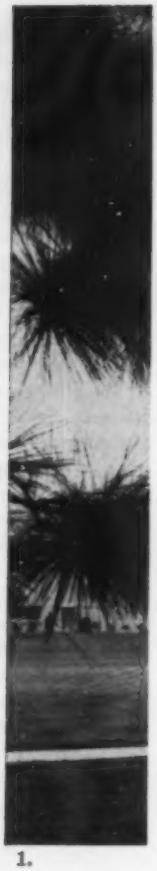
The Gates Rubber Company
Denver, Colorado

BP-7

Gates Super HC V-Belt Drives

For more facts circle 535 on Reply Card

ELECTRONICS MANUFACTURER KNOWS PRECISION... CHOOSES WESTINGHOUSE EQUIPMENT TO PROTECT PRODUCT QUALITY



1.

Electronic Communications, Inc., designers and suppliers of precision electronic equipment, recently added 165,000 square feet of production area. To meet military specifications, the company has the most comprehensive environmental test facility in the southeastern U. S. Regular tests include shock, vibration, explosion, fungus, salt-sea atmosphere, sand and dust, temperature and altitude. Because of this, high electrical reliability is required.

To meet this demand, Bail, Horton (architects and engineers) specified a double-ended power center to feed power throughout the plant addition. The Westinghouse equipment provided was balcony mounted, saving valuable floor space. Double-ended design with tie breaker permits entire switchboard to be fed from either transformer at reduced voltage to maintain lighting, air conditioning and environmental tests during emergency.

Management at Electronic Communications has declared that "specifications were written around Westinghouse equipment because the high quality of Westinghouse products was desired . . . quality second to none. Experience of our plant engineering personnel with Westinghouse products has demonstrated the reliable performance and low maintenance expense we can expect in the future."

On these and the following two pages, read how Westinghouse helps another company enter the competitive '60s Powered-Up for quality. *You can be sure . . . if it's Westinghouse.*

J-94159-1

2.

Westinghouse

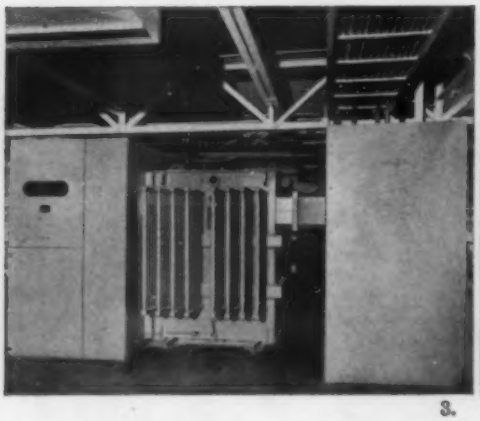
1. Attractive, modern buildings house Electronic Communications, Inc., of St. Petersburg, Florida.

2. DB-50 air circuit breakers are used as main and tie breakers in low-voltage distribution switchboard. Molded case type AB breakers serve as feeders. Breakers can readily be added to switchboard, minimizing changeover expense. Examining equipment are M. A. Lochridge, Westinghouse; John Feltman, Manufacturing Manager at Electronic Communications; and J. E. Gabrio, Gabrio Electric.

3. Heart of the plant distribution system is a 1500-kva double-ended power center. A fused 15-kv type LCB switch protects primary circuit. Shown is one of two 750-kva Inerteen®-filled transformers, which steps down voltage to 480 volts for throat-connected switchboard at right. Entire power center is balcony mounted, freeing area below.

4. Check and double-check . . . Electronic's finished products receive many inspections at test boards like these.

5. John Gabrio; J. R. Miller, Westinghouse Construction Engineer; and George Low, Plant Maintenance Supt., observe compact, lightweight Westinghouse DT-3 dry-type transformer conveniently mounted overhead. This 75-kva unit, one of many in the plant, steps voltage down economically at point of utilization. Distribution panelboard at the right, equipped with AB breakers for short circuit and overload protection, distributes voltage to lighting panels and air conditioners. At center are 100- and 200-amp AB-I breakers, and to the left of these, air conditioning safety switches.



3.

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J-94159-2

6. Eight runs of 225-amp, aluminum plug-in bus duct carry full power throughout the plant. Plug-in circuit breakers, as shown top left, provide a convenient means of power take-off . . . can be moved or added to accommodate load changes. Breakers protect both circuits and power equipment. Bill Barlow, Wesco Salesman, at right, explains the safety door interlock feature of the plug-in breaker unit to John Gabrio and George Low.

7. George H. Bail, Bail, Horton and Associates; L. J. Hennessy of A. P. Hennessy & Sons; and John Feltman review air conditioning plans. Flexibility of the equipment made it possible to side-mount fan sections and discharge horizontally to six separate zones throughout the plant. "Free return" reduced cost of duct by several thousand dollars. System, made up of six 50-ton Westinghouse units, is as economical as possible. Maintenance can be planned ahead, one unit at a time.

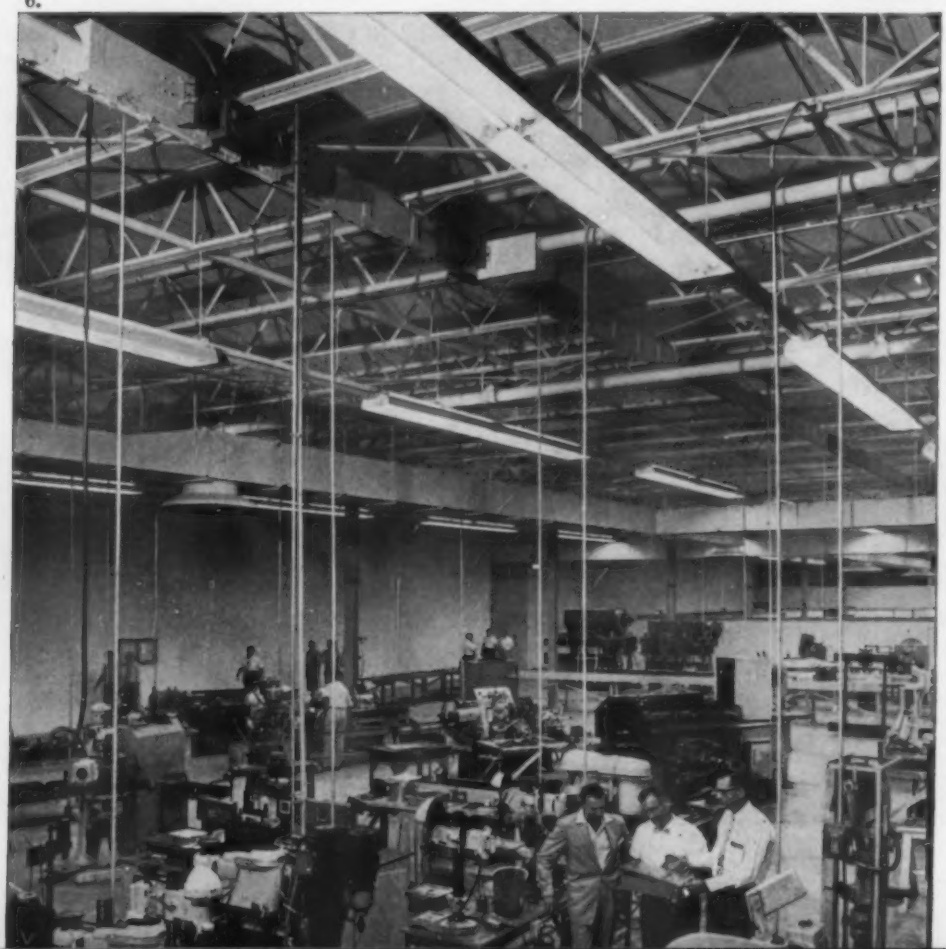
8. Specialized test area, free of RF interference, behind protective copper screening; beyond, a general assembly area.

9. George Low, with M. A. Lochridge, operates a 3-pole, F frame breaker in a Westinghouse convertible distribution panelboard. AB De-ion® breakers feed and protect lighting transformers and power circuits. For change-over or expansion, breakers may be interchanged or added in the panel.

10. Reviewing electrical system are: F. Godsey, President of E.C.I.; George H. Bail, Bail, Horton and Associates; L. J. Hennessy of A. P. Hennessy & Sons, General Contractors; M. A. Lochridge, Westinghouse Sales Engineer; John E. Gabrio, Gabrio Electric Co.; Ralph E. Bail of Bail, Horton; L. W. Willey, V.P. Operations, E.C.I.

Owner: Electronic Communications, Inc., St. Petersburg, Fla.
Architects and Engineers: Bail, Horton and Associates, Ft. Myers, Fla.
General Contractor: A. P. Hennessy & Sons, Inc., St. Petersburg, Fla.
Electrical Contractor: Gabrio Electric Co., St. Petersburg, Fla.
Westinghouse Distributor: Wesco, Tampa, Fla.

6. J-94159-3



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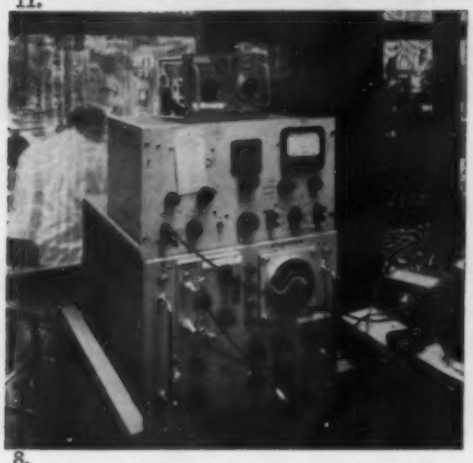

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Westinghouse

For more facts circle 536 on Reply Card

OPERATION AND PRODUCTION—pointers for the industrial plant engineer

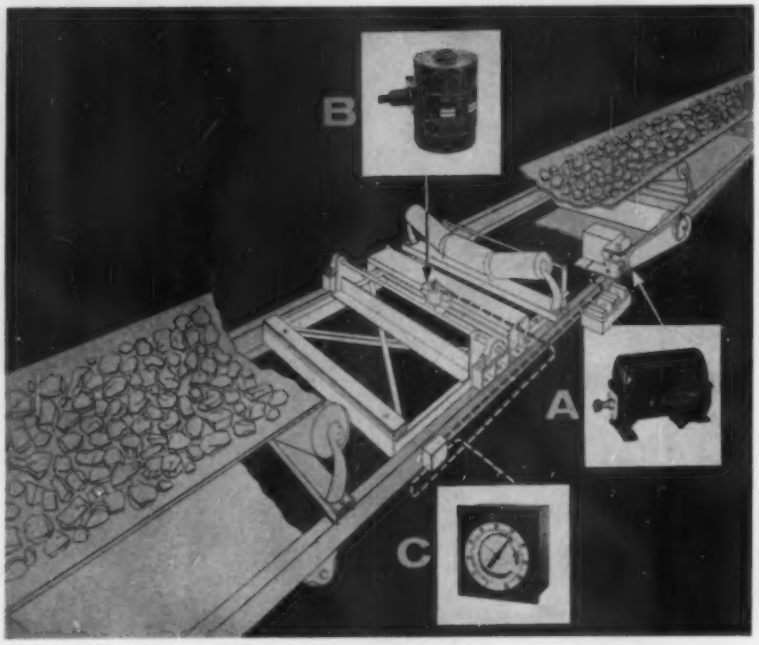
Edited by Vern Kempf

Belt Conveyor Scale Continuously Meters Flow of Materials

SOLID MATERIALS at various stages of processing are continuously weighed and in some cases controlled by electronic belt conveyor scales at the alumina plant of the Ormet Corporation, Burnside, Louisiana. Designed and built by Trans-Weigh Company, King of Prussia, Pennsylvania, the installation includes process regulating scales and also inventory-type scales.

Each of the electronic weighing units measures material weight and speed by means of a Belt-Meter system.

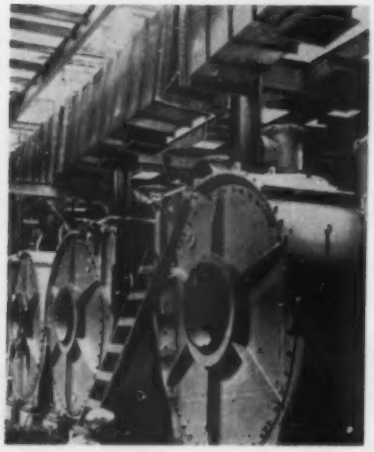
Speed of the belt is determined by a tachometer generator driven by the return belt. The weighing carriage is equipped with a resistance-type load cell that senses the weight. Output of the generator is fed to the load cell and the resulting output of the cell is transmitted electrically to a specially modified electronic potentiometer that indicates and records instantaneous flow. The recorder includes an integrator that displays total tonnage on a digital counter.



Tachometer generator, A, is driven by return belt to sense speed. Output of generator is fed to load cell, B, in weighing section. Resultant output is transmitted to electronic potentiometer, C, that indicates and records flow.

Iron Cement Seals Duct Joints

SEALING DUCT JOINTS at Duke Power Company's new Allen Plant, Belmont, North Carolina, is being accomplished with an iron cement.



Iron cement and close bolt hole spacing effectively seals large air ducts.

The joints are uniformly sealed and rendered absolutely air and gas-tight by this method rather than by welding or use of gaskets.

Iron cement is being used where duct flanges connect either with each other or with other equipment such as preheaters, fans and precipitators. Some 180 duct joints with a total length of close to 5000 ft have been sealed with Smooth-On No. 3, an iron cement made by Smooth-On Manufacturing Company.

Duct joint sealing is a demanding operation, partly because no leakage can be tolerated and because of the exceptionally large ducts used. The largest air duct is more than 20 ft high and 100 ft wide.

Sealing ducts of this size could have been done by welding, by use of gaskets with close bolt spacing or by application of iron cement with close bolt spacing. The last method was chosen for reasons of economy and ease of application. Also, use of the iron cement makes it possible to take the ducts apart if necessary. This is considered to be quite an advantage particularly where dampers and expansion joints are concerned.

In the cold air ducts these seals must withstand temperatures up to 265 F and up to 18-in. vacuum on a water gage. In the hot air ducts temperatures may be as high as 586 F and pressures up to 15 in. on the water gage.

Plant Appearance Changes Fast

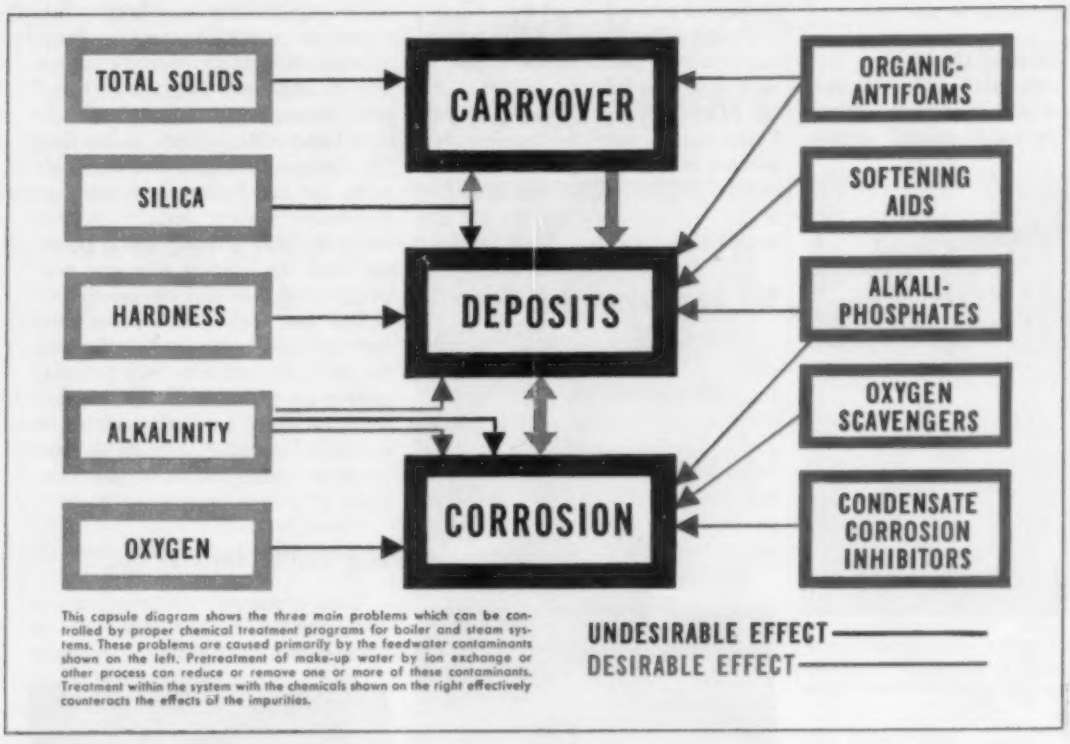
AN UNUSUALLY large application of aluminum vertical paneling was recently installed to remodel a 70 year old building in Toledo, Ohio. It took only two weeks for six men to apply 122 squares of special length vertical aluminum paneling over the common brick exterior of the four-story Romanoff Electric Motors Company building.

In addition to the aluminum ex-

(Continued on page 56)

BOILER WATER TECHNOLOGY...

Simplified Diagram of a Complex Problem... And Some Suggestions for Getting Satisfactory Answers



This capsule diagram shows the three main problems which can be controlled by proper chemical treatment programs for boiler and steam systems. These problems are caused primarily by the feedwater contaminants shown on the left. Pretreatment of make-up water by ion exchange or other process can reduce or remove one or more of these contaminants. Treatment within the system with the chemicals shown on the right effectively counteracts the effects of the impurities.

All boiler water treatment is aimed at preventing pickup of impurities by water, removing the impurities, or counteracting their effects. This simple statement of the jobs water treatment has to do gives no hint of the millions of manhours and dollars spent in research, testing and field experience – a great deal of it by Nalco – in efforts to reach these goals dependably and economically in all types and sizes of steam systems.

Your water treatment program should fit your particular needs

There are countless combinations of chemicals, equipment and methods for effectively treating boiler feedwater. Yet there is *one* combination that will prove to be the best for *you*.

It is the responsibility of Nalco people to know and understand all the possible approaches to the prevention of corrosion, deposits, and carryover. But their greater responsibility is to couple this technical understanding with a practical understanding of your particular needs.

That is why the Nalco Representative you call in will, first of all, determine the *quality* of water your plant needs. Whether it is merely hardness reduction, or complete demineralization, chances are his technical ability will enable him to develop a number of ways to produce it. But, most important – he has the practical understanding to know *which* of those methods is the most efficient and economical – *the most practical method* – for you.

A Nalco Program Based on Results

A Nalco program of water treatment for your plant is based on *all* the elements which affect results: chemical, mechanical, and operating factors. To do this, Nalco field personnel bring the full weight of unexcelled water treatment research and development, vast field experience, and specialized training and skills into use to recommend a program with one aim: the lowest overall cost *consistent with best results.*

Once established, your water treatment program includes regular checks by your Nalco Representative . . . Nalco believes that water treatment responsibility is continuous – and the thousands of Nalco-treated plants, many of them Nalco customers without a break for thirty years and more, are ample evidence that this belief works well in practice.

For prompt action on a Nalco program for your plant, call your Nalco Representative today or write:

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Nalco® ... Serving Industry through Practical Applied Science

For more facts circle 537 on Reply Card

OPERATION — PRODUCTION

(O and P begins on page 54)

terior, the inside of the building was completely renovated with new slab floors, offices and aluminum framed windows. The baked enamel vertical

Before and after photographs emphasize change in appearance to this building accomplished in two weeks.

aluminum paneling used was furnished by Crown Aluminum Industries, Inc., Pittsburgh, Pa. The remodeling job was designed by an architect and installed by a local siding contractor.

Porous Panels Improve Bin Flow

INCREASED use of automatic feed equipment in all fields calls for use of storage bins with controlled output rates. The problems inherent in bin flow of powdered or fine materials include bridging, caking and uneven flow rates.

When such flow is maintained to a weigh feeder system, lack of reliable feed becomes critical. Vibrators or shakers can normally be expected to provide reliable results. However, one large synthetic fiber manufacturer found the material persisted in bridging and flow was unreliable when using conventional bin vibrators.

An attractive solution to this problem was found by aerating or fluidizing the powder by means of inert gas or compressed air blown into the packed, almost solid powder. In this particular case the inert gas has to be nitrogen. This was done by blowing the inert gas through porous stainless steel panels lining the bin to provide a gaseous coated frictionless bin wall and by blowing additional nitrogen into the packed powder by means of perforated probes.

Design called for use of four porous stainless steel panels in the throat of each bin. The panels, furnished by the Micro Metallic Division of Pall Corporation, were to be installed without removing any sections of the existing bin walls. The only cut made in the existing walls was for the gas supply line.

Wet Blast Deburrs Hard Gears

WET BLAST equipment was installed by Brad Foote Gear Works, Inc., Chicago, for the single purpose of deburring ground and hardened gears. The light color and fine matte finish imparted has led to the use of this Liquamatte process on larger gears on which manual deburring is also performed.

Done after hardening, wet blasting

Simple wet blast equipment used to degrease and deburr hardened gears.

degreases the ground gears simultaneously with finishing so that all oil is removed and assembly is possible immediately after deburring. The Liquamatte equipment was furnished by the Techline Division of the Wheelabrator Corporation, York, Pa.

Reduce Handling 75 Per Cent

UNTIL RECENTLY, truck drivers delivering a pulverized stabilizer material to the Joliet, Ill., plant of Ruberoid Company dumped the material into a large receiving hopper until the hopper was full. As the material was delivered to the plant in 17-ton hydraulic lift trucks, much time was lost waiting for the hopper to empty enough to continue dumping the load.

Production delays were caused because the mechanical system could not empty the receiving hopper fast enough to permit the truck to dump continuously. High delivery prices due to long unloading times caused plant management to select an enclosed pneumatic system for handling the material. Designed and manufactured by the Fuller Company, the pneumatic system installation was made without altering plant layout and uses the existing receiving hopper, process bins and storage silo.

The one man control used with the new system has made it possible for the three men who were formerly used to accept jobs with higher classifications. Only one half hour is required to unload 17 tons of the material, providing improved prices because of reduced waiting time.

Slab Casting Improves Quality

CONTINUOUSLY cast aluminum slabs are better than those cast in conventional book molds since one of

Regulating casting speed in semi-continuous machine improves grain size.

the methods by which grain size of the cast material can be controlled is by regulating the casting speed. After an initial break-in period, a large slab casting and sawing installation designed to improve quality is now in full production at the Quaker State Metals Company, Lancaster, Pa.

Capable of producing six, 7½ by 52 by 144 in. aluminum alloy slabs simultaneously, the casting machines turn out all the ingots required for

the processing of sheet, strip and coil. The semi-continuous casting station and the circular saw with auxiliary conveying equipment were supplied by the Loma Manufacturing Co.

For subdividing and trimming the 12-ft long sheet ingots, the high speed circular saw is capable of cutting through a 12 in. by 52 in. aluminum alloy section in about one minute. The sawing machine is of the overhead sliding carriage design and employs a 48 in. diameter blade cutting at a speed of 6000 fpm.

Rig Speeds Shielded Arc Welding

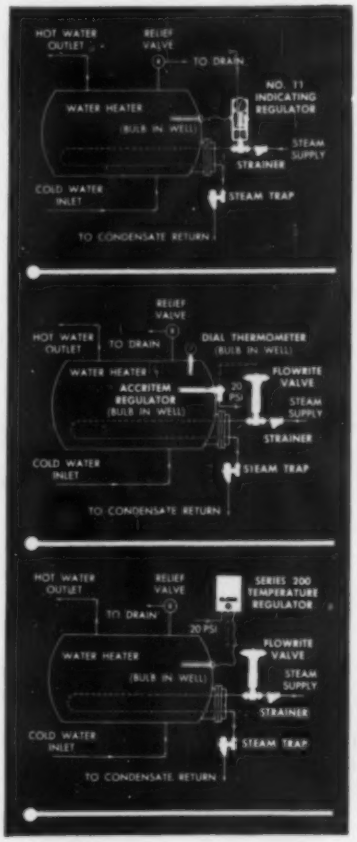
SPEED AND VERSATILITY are high among the characteristics required of production techniques employed at the U. S. Naval Weapons Plant, Washington, D. C. The plant attains these objectives in the fabrication of heavy steel plate assemblies through the use of eight self-contained, semi-automatic welding rigs.

Employing a fast semi-automatic welding process, these mobile welding stations are easily moved to work locations throughout the plant. Each dolly mounts a welding power supply, control unit, welding gun and hoses. It also carries its own supply of shielding gas and a self-contained cooling system—consisting of a radiator containing 8 quarts of coolant and a circulating pump.

As shielding gas and coolant supply travel with the rig, only electrical service is necessary at the point of operation. Thus welding can be performed at almost any plant location. All eight units were either original-

Portable shielded arc welding rig carries own supply of gas and coolant.

Practical Ways To Control Hot Water Storage Heaters



THE POWERS REGULATOR COMPANY
Dept. 361, Skokie 23, Illinois

Send me a free copy of Powers Engineer's Manual For Steam-Water Service

Name:_____

Title:_____

Company:_____

Address:_____

City:_____ Zone:____ State:_____

Specific requirement or problem:

These diagrams, plus clear and concise information on storage heater control, are available to you without obligation as part of the Powers *Engineer's Manual, Steam-Water Service.*

This manual has been specially prepared for plant use. It is available free to personnel whose job function covers operation and/or installation of steam-water service. Various control systems described and illustrated include: domestic hot water . . . instantaneous heat exchangers . . . heat exchangers for cooling . . . fuel oil heaters . . . pressure reducing . . . jacket water cooling . . . two-temperature hot water systems.

Send for your Engineer's Manual now! If you have a special requirement or problem ask for recommendations.

POWERS CONTROL

THE POWERS REGULATOR COMPANY
Dept. 361, Skokie 23, Illinois

In Canada: The Powers Regulator Co. of Canada Ltd. Downsview, Ontario

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Remove and install gears, bearings, wheels, pulleys, etc. quickly and easily with . . .

OTC HYDRAULIC "PUSH-PULLERS"

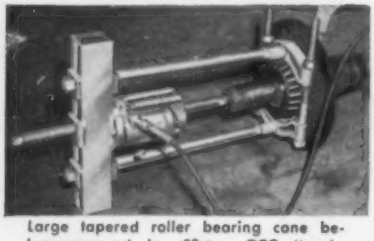
OTC hydraulic "push-puller" with attachment removes gear and bearing quickly and without damage. Push-puller (with legs threaded into a pulling attachment) is like a portable shop press.

Fifty-ton "push-puller" removing generator rotor assembly from shaft. Legs extend through the assembly, connect to a pulling attachment.

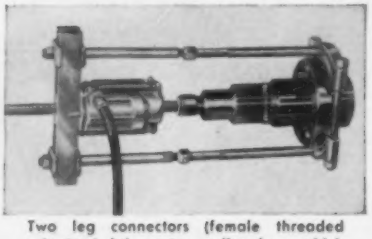
CUT MAINTENANCE COSTS AND MACHINE "DOWNTIME." SAVE PARTS!

OTC hydraulic "push-pullers" with attachments handle hundreds of tough, complicated pulling and installing jobs quickly, easily and without damage to parts.

Cut machine "downtime" and save parts by having the right tools in your shop to handle every job. Complete, versatile maintenance sets available in 17½, 30, 50 and 100-ton capacities. They pay for themselves in time saved.



Large tapered roller bearing cone being removed by 50-ton OTC "push-puller" and attachment connected by threaded adapters.



Two leg connectors (female threaded adapters) join extra puller legs which thread into pulling attachment to pull a bearing.

Contact your OTC distributor for further information, or write for Industrial Maintenance Catalog. No. P-9.

RESEARCH · ENGINEERING · DEVELOPMENT

OTC

OWATONNA TOOL COMPANY

446 CEDAR ST. • OWATONNA, MINN. • CABLE: TOOLCO

Designers and Manufacturers of the world's most complete line of Maintenance Tools and Hydraulic Equipment.

PULLERS AND PULLER SETS · HYDRAULIC RAMS AND PUMPS · HYDRAULIC SHOP PRESSES · HAND TOOLS

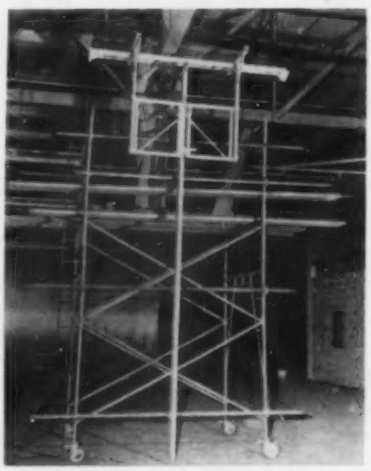
For more facts circle 539 on Reply Card

ly designed for or have been converted to the Dual Shield process. Developed by National Cylinder Gas, Division of Chemetron Corp., the process employs a flux cored electrode and inexpensive CO_2 as the shielding gas. The flux cored electrode minimizes the spatter associated with conventional CO_2 welding processes and finished welds require little cleaning.

Production supervisors report little operator training is required because the weld area is visible at all times. After adjusting the voltage, current, wire feed rates and CO_2 flow, the operator merely pulls the welding gun trigger, strikes his arc and welds. This operating simplicity and arc visibility have led to more consistent weld quality than previously experienced with stick electrodes.

Versatile Hoist Saves $50 a Day

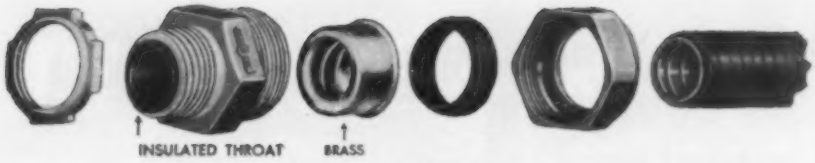
AN ALUMINUM HOIST assembly that lifts and positions fluorescent fixtures reduced manpower require-



Hoist assembly elevates fixture, horizontal arms move in over scaffold.

ments 50 per cent and saved $50 per day on labor costs in the new Alcoa Aluminum Building, Edison Township, New Jersey. A total of $3000 was saved on the installation of 1200 four-foot and eight-foot fixtures.

Known as "Mechanical Man", the aluminum hoist assembly, manufactured by Up-Right Scaffolds, Berkeley, California, is attached to stand-



Malleable Iron Liquid-Tite Connectors

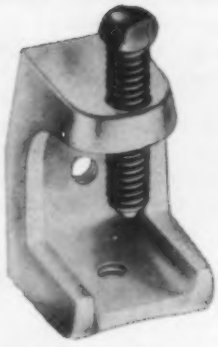
QUALITY MALLEABLE IRON FITTINGS ARE AVAILABLE!

GEDNEY'S

Complete Line is Precision-Made of Unbreakable Malleable Iron . . .

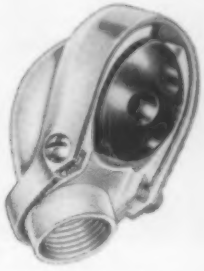
- *Unmatched for Toughness*
- *Impervious to Corrosion*

GEDNEY FITTINGS FIT



M.I. Beam Clamps

M.I. 90° Corner Adapters and Corner Elbows



M.I. Entrance Caps

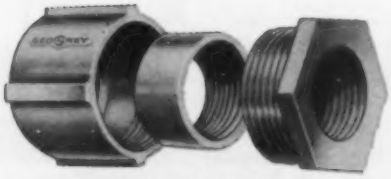
M.I. Offset Connectors and Offset Nipples

M.I. Insulated Bushings

GEDNEY
ELECTRIC COMPANY, INC.
GEDNEY
AMERICAS BLDG. • RADIO CITY • NEW YORK 20
Foundry, Factory and Shipping Point: Terryville, Conn.

M.I. Conduit Bodies

M.I. Armored Cable & Non Metallic Connectors

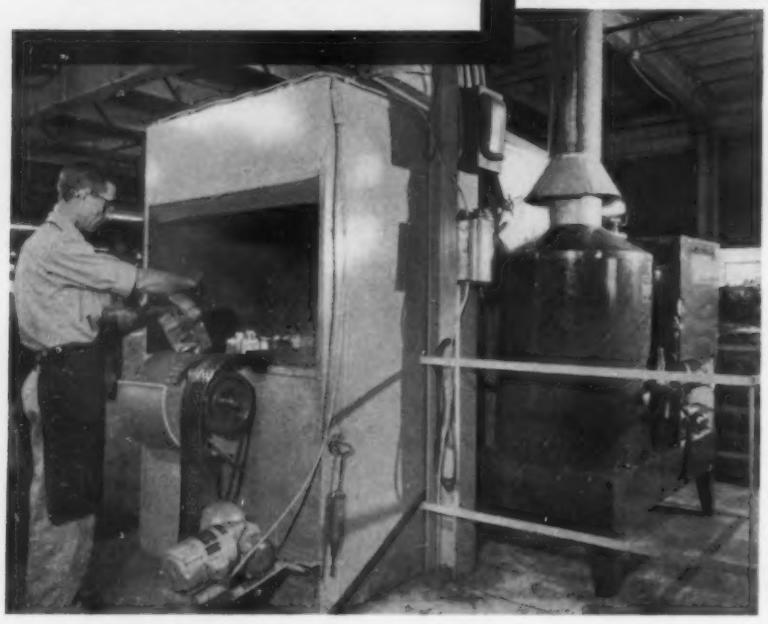


M.I. 3 Piece Conduit Couplings

For more facts circle 540 on Reply Card

Cuts cleaning time from 1¾ hours to 15 minutes

Gravely Tractors, Inc., Dunbar, W. Va., mounts one cleaning gun of Malsbary 230 steam cleaner 12" above stainless steel conveyor belt, the other 12" beneath belt, and runs castings between them.



Degreasing and air blasting to get rid of oil, grease and machine grindings on crank cases—handled 60 at a time—just took too long. Then Gravely Tractors installed a 2-gun Malsbary 230 steam cleaner, which degreases and thoroughly cleans castings in 1/7th the time formerly required.

PLACE CLEANER WHERE YOU WISH

...adjacent to work, or 100 to 200 ft. away. This option is yours because the Model 230 is equipped with nozzle control with which operator starts and stops solution flow by squeezing and releasing his grip on hand gun. The Gravely installation is in the assembly area, where solution flow is controlled automatically. Cleaner occupies only 63" x 36" floor space.

Model 230 delivers 180 gph at 60 to 100 psig without smoke, soot or fumes. Thermostat holds solution temperature to within 50° F. of setting. Complete range of Malsbary models for phosphating, production cleaning and maintenance.

MALSBARY

Malsbary Manufacturing Co. • 845 92nd Ave., Oakland 3, Cal.

Malsbary Manufacturing Co. / 845-92nd Ave., Oakland 3, Calif. 152

I would like ☐ Industrial Steam Cleaning portfolio; ☐ Phosphating Manual; ☐ Personal consultation on cleaning problems.

Name_____ Position_____

Company_____

Address_____

For more facts circle 541 on Reply Card

OPERATION—PRODUCTION

(O and P begins on page 54)

ard aluminum or steel scaffolds. The 50-lb and 100-lb fixtures were placed on lifting arms that elevate quickly along the vertical track. The winch supplying this lifting force is operated from the top of the scaffold.

Lifting arms also move horizontally on rollers to bring the fixture in over the top of the platform. This feature permits a single workman to install fixtures easily at the 16-ft mounting height. Two, 2-man teams working with two scaffolds handled the entire 1200-fixture installation.

Tips On Unit Heater Maintenance

ARE THE unit heaters in your plant doing the job they were designed for? Or are you having trouble with motor failures, excessive noise or uneven heat distribution?

Chances are the trouble is not in the heater itself, but is caused by minor maladjustments, incorrect sizing, or lack of maintenance. To help plant personnel find the cause of trouble, heating specialists at Modine Manufacturing Company, Racine, Wis., have prepared this checklist:

Fails to maintain desired temperature—

- Exhaust air may be excessive. Fans may have been added after heaters were installed.
- Unit heater, boiler, pump or piping may be undersized.
- Heater may be operating at second or third speed, when sized for high speed operation.
- Thermostat not working, or located in wrong place.
- Unit heater mounted too high above work area.

Unit blows cold air—

- Aquastat or steam trap not functioning.
- Manual shutoff valve closed.
- Improper venting.
- Steam pressure too low or water not hot enough.
- In steam systems, cooling leg may be too short or return line plugged.
- In hot water systems, pump may be undersized.

Unit does not operate when heat is needed—

- Defective motor or electrical connections.
- Thermostat, aquastat, or pressure

EXACTLY THE PANELBOARD YOU WANT

Right Off Your Square D Distributor's Shelf!

In our contracting business, we find QMB PANELBOARDS are just the thing for heavy industrial jobs. The switches are heavy-duty horsepower rated and they plug in just like plug-in duct units or drawout air circuit breakers. The switch unit I'm holding is a twin 60 ampere 3-pole unit, rated 600 volts. We picked up the entire panelboard this morning from our local Square D distributor's stock to use on a 480 volt job. *We'll have it installed and wired by tomorrow afternoon—and no overtime.*

Notice that this 240 volt switch is much smaller than the 600 volt unit. That means we can put more circuits in the same size panelboard. Since Square D started making these new smaller units, we've been using QMB on all our commercial jobs. The interiors and boxes are the same for both 240 and 600 volt panelboards. That means one stock can work for both. *We can get the complete panelboard from our local Square D distributor the same day the job develops.*

We don't gang separate safety switches and motor starters over a trough any more. The new QMB MOTOR STARTER PANELBOARD makes a much cleaner job. It's easier to install, it costs no more, and it's in our distributor's stock. In our business, we're concerned with overall installed costs. We find the installed cost of the QMB STARTER PANELBOARD is no greater than that of separate components. The interlock between the switch and starter doors makes a much safer installation, too.

• Plug-in construction combined with heavy-duty industrial design has made the QMB PANELBOARD a tremendous success. In fact, the flexibility of this unit plus availability from distributor stocks, has made it the leading power panelboard on the market. It's available either in 600 volt or 240 volt construction. Motor control units are available for use with either voltage switch units. When switch units exceed 200 amperes, the panelboards can be obtained from the nearest Square D Assembly Plant, completely factory-assembled. It's the modern fusible standard.

For additional information
write Square D Company, 1601 Mercer Road, Lexington, Kentucky

SQUARE D COMPANY

wherever electricity is distributed and controlled

For more facts circle 542 on Reply Card

Dust Control is a job for Engineers

The "rule of thumb" methods of the inexperienced, or the "engineering rules" of an experienced design, fabrication, and installation firm—which will you select for your dust control problems?

Kirk and Blum offers you . . .

ENGINEERING—a staff of qualified engineers with proven ability to solve your dust control problems.

RESEARCH—continuous research on full scale equipment, to develop the most efficient systems.

EXPERIENCE—over 50 years of dust control service to the woodworking industry.

Every Kirk & Blum installation is based on a complete service: Design — Fabrication — Installation, backed by K & B's acceptance of One Undivided Responsibility for the system to assure your satisfaction.

On your dust control problem consult Kirk and Blum, craftsmen in dust control for the woodworking industry, where fine craftsmanship is appreciated. The Kirk & Blum Manufacturing Company, 3189 Forrer St., Cincinnati 9, Ohio.

KIRK & BLUM DUST CONTROL SYSTEMS

For more facts circle 543 on Reply Card

OPERATION—PRODUCTION

(O and P begins on page 54)

limit control not functioning.

Heat does not reach floor level—
- Unit undersized or mounted too high.
- Louvers not adjusted properly.
- Heater operating at wrong speed.
- Final air temperature may be too low.
- Wrong type of diffuser on vertical models.

Noisy unit—
- Fan blades bent, dirty or out of balance.
- Bolts, screws or fan hub loose.
- Motor thrust bearing out of adjustment.
- Motor mounting may be bent and the fan not positioned properly in the venturi.
- Heater or conduit mounted so rigidly that they transmit vibration noise.
- BX cable touching heater.

Hot blasts on workers—
- Air stream aimed at workers.
- Louvers not adjusted properly.
- Final air temperature may be excessive.
- Wrong type of diffuser.

Operating cycle too long—
- Thermostat improperly located on cold wall.
- Unit undersized.
- Heavy exhaust fan load.
- Aquastat or pressure limit control not functioning.

Motor failures—
- Voltage fluctuations too great.
- Improper electrical connections or undersized wiring.
- Too much or too little lubrication.
- Air flow restricted by clogged condenser, closed louvers or too much duct work.
- Fan out of balance.

Rectifiers Replace Generators

MODERNIZATION of a rail re-rolling mill at the Chicago Heights Works of Inland Steel Company included electrical equipment designed to provide the versatile operation required for a modern mill installation. Included with the electrical equipment was a 2500 kw, 600-volt d-c, mercury-arc rectifier, supplied by Allis-Chalmers for main drive support and new mill duty control.

An important feature of this in-

Variable voltage board has a "run" bus supplied by mercury-arc rectifier.

stallation is the use of alternating current auxiliary drives with complete elimination of conventional constant potential sources of power. The 12-tube Excitron mercury-arc rectifier supplies the "run" bus and a low voltage silicon rectifier with current limiting characteristics is used on the jog bus.

Simple System Solves Problem

How DO YOU start a seven-ton mass at a high rate of speed, keep it moving and still be able to stop it suddenly without damaging the mechanism or the work piece? Engineers at National Electric Welding Machines Company, Bay City, Mich., were confronted with this problem recently when they designed a massive winding reel for the Keystone Steel and Wire Company, Peoria, Illinois.

Their solution was a simple pneumatic system that uses a new theory in the application of valving to provide motion control from rapid acceleration to emergency stop without starting surge or loss of register.

Air circuits control the opening and closing of a reel on which the wire fabric is coiled. The reel consists of two cylinders or mandrels moving in opposite directions on flat, cast iron slides. Each cylinder weighs 7000 lb and has a 10-in. bore. The pistons are extended to open the reel.

Principle of the system is rapid bleed down of air pressure for the start of any movement. Unrestricted disgorging of air reduces back pressure to a minimum and concentrates full pressure for rapid acceleration. The piston transits its full stroke of eight feet, ten inches in just six seconds.

THE BIG NEWS IN AIRLESS PAINTING

A rugged 5-gallon airless pump of simplified design. Provides peak "one-gun" performance!

Here's a portable unit that's designed for inplant maintenance jobs as well as limited-production painting. 5-gallon airless pump includes a proved air motor, clamp-on lid, 5-gallon material pail, and carrying handle. It may be used with your present DeVilbiss airless gun and hose. If you don't already have them, investigate DeVilbiss complete airless outfits. Priced as low as $300. Contact your nearest DeVilbiss jobber or representative! The DeVilbiss Company, Toledo 1, Ohio. Also Barrie, Ontario; London, England; São Paulo, Brazil. Branch offices in principal cities.

Only $192.50*

FOR TOTAL SERVICE, CALL
DEVILBISS

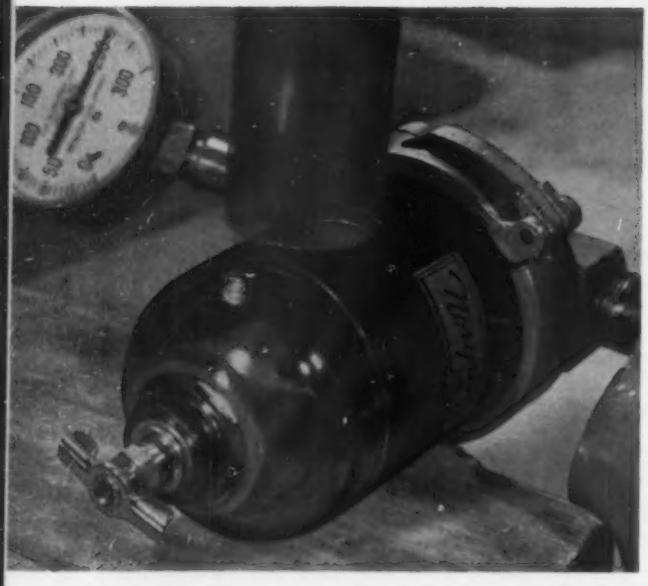
*Slightly higher in West

For More facts circle 544 on Reply Card

NEW NORGREN SAFETY GREEN* TRANSPARENT BOWL WITHSTANDS RIPPING IMPACT OF BULLETS

*TRADEMARK

Norgren SAFETY GREEN* bowl doesn't shatter... yet is fully transparent



Heavy steel bar dropped endwise from 12 ft. height merely scuffed surface of bowl carrying over 200 psi internal pressure.

Bowls for compressed-air-line filters and lubricators should be transparent to permit quick visual inspection. However, in the past, unusual or special applications often required the use of bowl guards or wire reinforcements . . . sacrificing the advantage of transparency.

Now . . . from Norgren . . . you get a fully transparent, yet super-tough, impact-resistant bowl designed for even the most severe service. As these photos dramatically portray, the new Norgren bowls are transparent and are able to withstand conditions far more exacting than ever encountered in ordinary use. Non-shattering bowls mean reduced replacement cost, less air-tool and equipment down-time, savings in maintenance and operating costs, greater employee safety.

These new SAFETY GREEN bowls are now available for most Norgren air-line filters and lubricators—or may be obtained separately for replacement purposes from your local Norgren representative or distributor. Or, write for full information.

As a further test of toughness, the new Norgren bowl was placed in a heavy machine shop vise . . .

then compressed almost flat. Even in this extreme position, the bowl did not break or even crack.

Turned and squeezed again back to its original shape, the bowl still showed no cracking. Except for vise marks almost good as new!

...WITH NO SHATTERING!

Unretouched high-speed photo by University of Denver Research Dept. shows new Norgren SAFETY GREEN Bowl a split second after penetration by bullet. Initial pressure of 265 psi is being relieved through bullet hole.

Specify Norgren SAFETY GREEN Bowls

Large photo shows bowl after test. Only damage to bowl is clean bullet hole with no cracking, crazing or shattering. Impact has broken gauge. This test clearly demonstrates extreme toughness of Norgren SAFETY GREEN bowls.

FOUNDED IN 1926

. . . for complete information, write

C. A. NORGREN CO.

3443 SOUTH ELATI STREET ENGLEWOOD, COLORADO

For more facts circle 545 on Reply Card

Quality metal products deserve

"the finishing touch" of Mahon

another example . . .

'maximum protection' cargo drums from top U. S. supplier

Mahon's metal cleaning and rust-inhibiting line installed at the Port Arthur, Texas, plant of a major supplier assures a "100% scale-free" product. Complete finishing is after fabrication to provide the best in cargo drums.

Mahon's Industrial Equipment Division knows production finishing best. If you make cosmetic cases or appliances, bicycles or railroad cars, or any other metal product . . . and if quality comes first . . . call in Mahon. Improved finishing can be the easiest and most economical product improvement you'll ever make. New paints, new methods broaden the possibilities. Find out what the 'finishing touch' of Mahon can do with your products . . . your costs . . . your sales. Get in 'touch' with Mahon.

MAHON INDUSTRIAL EQUIPMENT

• Finishing Systems • Metal Cleaning Equipment • Painting Facilities—spray, dip and flo-coaters • Drying and Processing Ovens • Special Plant and Production Equipment

WRITE FOR MAHON CATALOG A-661
ALSO IN SWEET'S P. E. FILE

THE R. C. MAHON COMPANY

DETROIT 34, MICHIGAN

MANUFACTURING PLANTS—
Detroit, Michigan and Torrance, California
SALES-ENGINEERING OFFICES—Detroit, New York, Chicago, San Francisco and Torrance.

YOUR BIGGEST VALUE IS IN MAHON'S PLANNING & ENGINEERING EXPERIENCE

MAHON

For more facts circle 546 on Reply Card

For more facts circle 547 on Reply Card →

NEW General Electric Industrial Miniature Oil-tight Push Buttons Give You . . .

COLORS UNLIMITED, OVER 40% SPACE SAVINGS

Now you can reduce the size of your control panels at least 40 percent. New General Electric miniature oil-tight push buttons require only about half the panel space of heavy-duty oil-tight units.

Improve machine appearance. Unlimited color combinations are available in operators and rings to complement your equipment—provide positive color identification from any angle. Color is permanent; won't wear off, chip or fade.

Industry's first full line allows you to design entire panels with miniature units. Choose combinations of: standard (with or without guard) and mushroom-head push buttons; wobble stick operator; maintained and spring-return selector switches; coin-operated, cylinder-lock and bat-lever selector switches; resistor and transformer-type illuminated push buttons, indicating lights, and push-to-test lights. G-E miniature push buttons are available in complete units or as separate components, to allow you to make up any form you need with a minimum stock.

Call your General Electric sales engineer or distributor today, or write for publication GEA-7127, General Electric Co., Schenectady 5, N. Y. 811-22

Progress Is Our Most Important Product

GENERAL ELECTRIC

FULLER PNEUMATIC CONVEYING SYSTEMS INCREASE PRODUCTION, CUT CONTAMINATION FOR GOODYEAR

Recent installation of specially engineered Fuller Airveyor® pneumatic conveying systems to handle pelletized rubber has helped Goodyear Tire and Rubber Company increase production. These systems are the latest Fuller design resulting from over 15 years experience in pneumatic conveying of rubber pellets. These completely enclosed automatic systems virtually eliminate contamination problems and greatly reduce the chance of loss due to spoilage.

Automated handling of crude rubber with Fuller Pneumatic Conveying Systems, in place of conventional rubber slab sheeting on a mill, is the key. One Airveyor system conveys the pelletized rubber from the pelletizer to a weigh station, a distance of 500 feet. Four more systems operate from the sink dump scales to inlet spouts of the finish-run Banburys.

All of these Airveyor pneumatic conveyors are of the vacuum type, employing positive pressure exhausters for air supply. Each conveying system is equipped with its own individual bag-type filter, automatic in operation, which provides for 100% visible dust retention. Exhausters and filters are located on the roof. A control panel permits manual or automatic operation of the entire handling system.

If you are handling dry, bulk, granular materials, a Fuller Conveying System application-engineered to your process can be equally advantageous. Look to Fuller, whose range of products coupled with experienced know-how offers you the best *single source* for solving pneumatic materials handling problems. Just call or write Fuller today outlining your problem—no obligation, of course. A-288 1954

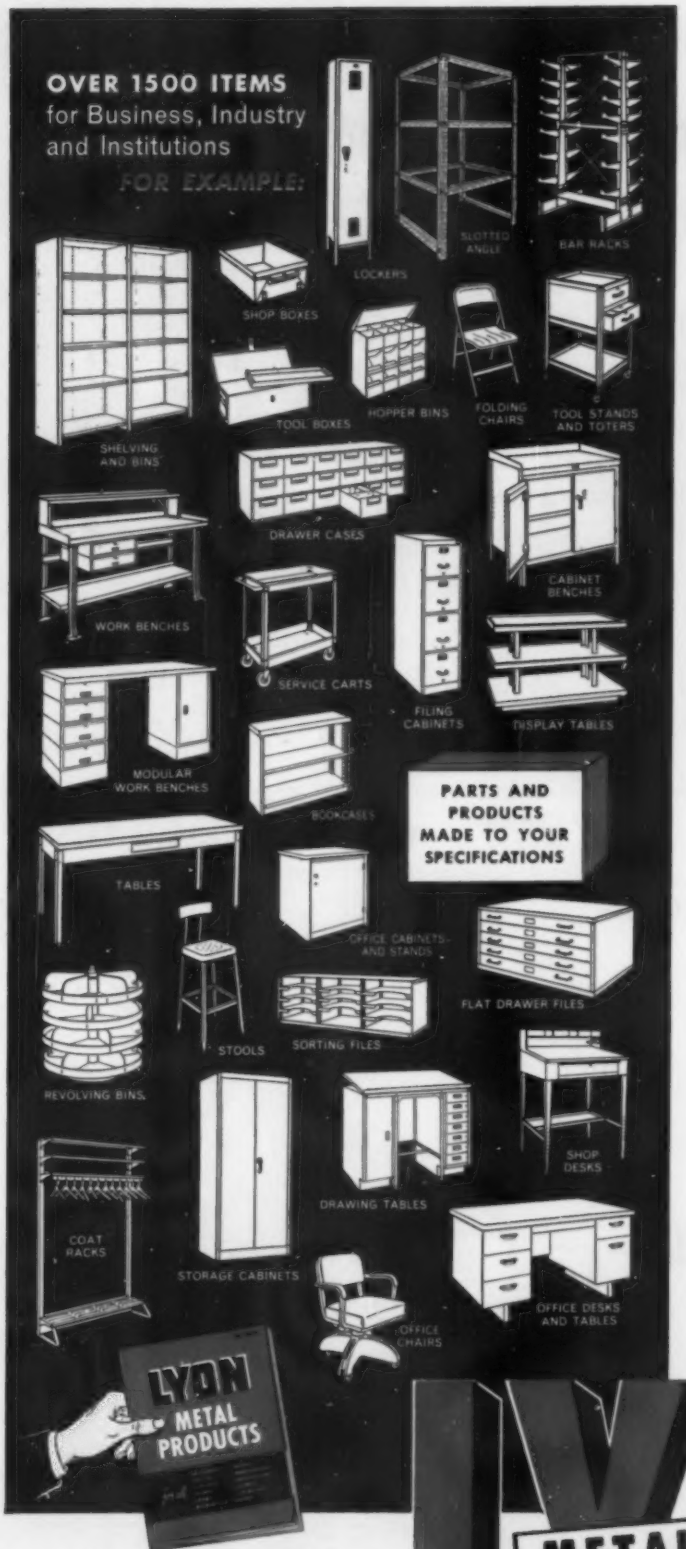
See Chemical Engineering Catalog for details and specifications

FULLER COMPANY GENERAL AMERICAN TRADE MARK

FULLER COMPANY
138 Bridge St., Catasauqua, Pa.
Subsidiary of General American Transportation Corporation
Offices in Principal Cities Throughout the World

For more facts circle 548 on Reply Card

Fuller
....pioneers in harnessing AIR



7 TO 1

"If your company were in the market for steel equipment such as steel shelving, lockers, work benches, shop boxes, etc., what manufacturers would you consider?"

That was the question an independent survey organization put to key men in companies throughout the country back in 1955. They gave Lyon 5 times more first choice votes than any other manufacturer.

In a comparable survey made in 1960, Lyon's first choice margin increased to 7 to 1—and Lyon received more exclusive mentions than the next twenty-two companies combined!

Your nearest Lyon Dealer offers the world's most diversified and *most preferred* line of steel equipment—quality protected to give you the most for your investment.

LYON METAL PRODUCTS, INC.

General Offices: 391 Monroe Ave., Aurora, Illinois
Factories in Aurora, Ill.—York, Pa.—Los Angeles
Dealers and Branches in All Principal Cities

THIS CATALOG ILLUSTRATES THE WORLD'S MOST DIVERSIFIED LINE OF STEEL EQUIPMENT *IT'S FREE!*

LYON® METAL PRODUCTS

For more facts circle 549 on Reply Card

Controlled environment assures uniform product quality, boosts "O" ring output

Controlled thermal conditions play a vital role in the manufacture of rubber "O" rings at Lebanon Manufacturing Company, Lebanon, Tennessee, a Division of Precision Rubber Products Corporation.

A specially designed Johnson Air Conditioning Control System maintains the exact temperatures required for the various manufacturing operations as well as for the comfort of plant and office personnel. Of particular importance is the need for temperature control that permits manufacturing to extremely close tolerances.

Here, as in thousands of other Johnson-equipped plants, a controlled thermal environment results in greater productivity, more uniform product quality, and improved worker efficiency.

Johnson Pneumatic Control Systems are applied to all types and makes of air conditioning, heating, and ventilating equipment and to a wide range of industrial processes. Each system is engineered and installed to meet the specific requirements of the individual plant. Next time you are considering controls, investigate the advantages Johnson Control can give you — in performance, dependability, and operational savings. Johnson Service Company, Milwaukee 1, Wisconsin. 105 Direct Branch Offices.

JOHNSON CONTROL

PNEUMATIC SYSTEMS

DESIGN • MANUFACTURE • INSTALLATION • SINCE 1885

Blanks for rubber "O" rings are stamped from sheet stock. Controlled air conditions are necessary to assure sharp, clean cuts.

In the press room, blanks are molded into finished "O" rings. After molding, controlled temperatures keep rings from becoming sticky and eliminate handling problems during trimming and final inspection.

To compensate for heat generated by the re-sheeting presses and to allow continuous operation, a Johnson thermostat and chilled water valve supply 40F water for the press rolls.

Lebanon Manufacturing Company, a Division of Precision Rubber Products Corporation, Lebanon, Tennessee. Schweiger, Heapy & Associates, architects and mechanical engineers, Dayton, Ohio; Henry Stock & Sons, general contractors, Dayton, Ohio; John Bouchard & Sons, mechanical contractors, Nashville, Tennessee.

For more facts circle 550 on Reply Card

new–lube-free...

STERLING
CAUTION
Sealed and shielded bearings require no lubrication.
Keys are fabricated from tough elastic material to eliminate key and keyway wear.
Wear-resistant non-metallic bushings require no lubrication.
Shaft surfaces are corrosion-proof and require no lubrication.

...Sterling's variable speed drive never requires lubrication

Costs Reduced—One of management's biggest headaches has been the development and maintenance of proper lubrication schedules. As a consequence, lubrication problems have long been the cause of variable speed drive failures, pulley wear, sticky pulleys, shortened belt life, excessive noise, and many other equally costly problems.

High labor costs, coupled with increased maintenance needs, are major management problems.

Lubrication Eliminated—Now, Sterling has eliminated all lubrication maintenance problems. No part of a Sterling variable speed drive needs to be lubricated.

All bearings, sealed and shielded, are factory-lubricated and therefore require no lubrication. Shaft surfaces are impregnated with a special exceptionally tough and wear-resistant material which eliminates need for lubrication. The non-metallic bushings are also fabricated from a special material that is equally wear-resistant.

Special Load-Bearing Surfaces—At no time do these surfaces require any attention. Even the keys are fabricated from a tough elastic material and will not wear out.

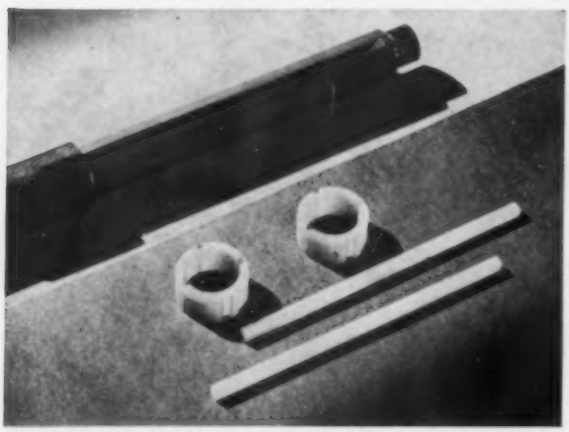
Fret corrosion, long a problem with metallic load-bearing surfaces, is completely eliminated since non-metallic surfaces now carry the load. Sticky pulleys, frequently the result of improper lubrication, are no longer a problem.

Sterling's new "Lube-Free" variable speed drive can be installed in any location, no matter how inaccessible, since lubrication maintenance is no longer needed.

Other Benefits—Costs are reduced, money saved, when lubrication maintenance is no longer necessary. Belt life is lengthened; pulley wear is eliminated. Bearing life may also be lengthened by the elimination of worn pulleys—often the cause of vibration and bearing wear.

All other Sterling variable speed advantages are present in this new "Lube-Free" drive: wide range of speeds, heavy duty cast iron case, finger-tip speed control, etc.

Information Available—Complete application and product information is available by writing Dept. B-5, Sterling Electric Motors, Inc., 5401 Telegraph Road, Los Angeles 22, California—or by contacting the Sterling field engineer in your area.



Shaft surfaces are extremely tough; material provides unusual chemical resistance and anti-frictional properties that make an excellent load-bearing material operating under extremely low or high temperatures. Keys and bushings are fabricated from a material proven to have outstanding abrasion resistance; holds up indefinitely under frictional conditions, thus eliminating need for lubrication.

This V & O Notching Press is powered by a new Sterling "Lube-Free" variable speed drive. It will never need lubrication. Similar units have been installed in the food processing industry. The elimination of lubrication is particularly important in the food processing industry where variable speed drives have such wide application, and where oil and grease create sanitation problems.

Hathaway INSTRUMENTS INC.

Sterling Electric Motors, Inc.

5401 TELEGRAPH ROAD, LOS ANGELES 22, CALIFORNIA.
A Subsidiary of HATHAWAY INSTRUMENTS, INC.

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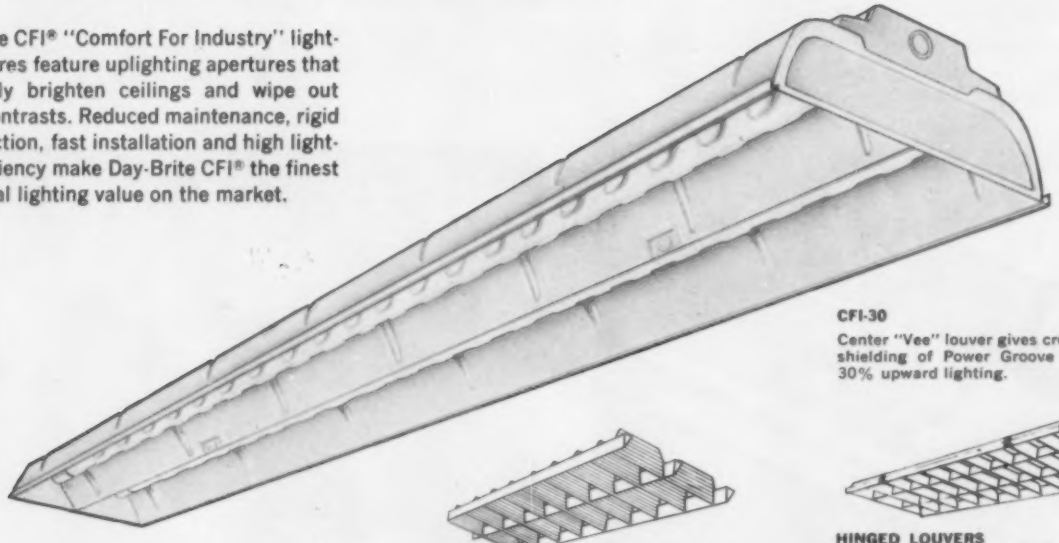
Whatever your reasons for wanting

- ☐ Increase production
- ☐ Avoid mistakes
- ☐ Utilize space better
- ☐ Prevent accidents

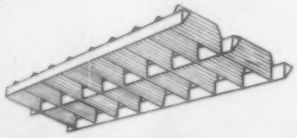
...you'll find the answers in

Day-Brite CFI® "Comfort For Industry" lighting fixtures feature uplighting apertures that cheerfully brighten ceilings and wipe out harsh contrasts. Reduced maintenance, rigid construction, fast installation and high lighting efficiency make Day-Brite CFI® the finest industrial lighting value on the market.



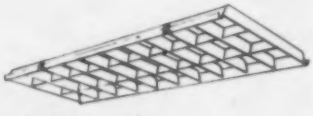
CFI-30

Center "Vee" louver gives crosswise shielding of Power Groove lamps. 30% upward lighting.



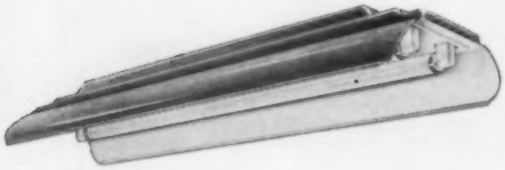
HINGED ALZAK ALUMINUM PARALOUVERS®

Provide the ultimate in visual comfort. Use with CFI-25 and CFI-30 fixtures. PARALOUVER Patent Nos. 2633799 and 507541.



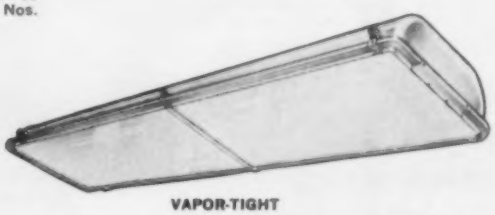
HINGED LOUVERS
(Baked white finish)

Use for critical seeing tasks requiring additional shielding, with CFI-10, CFI-15, CFI-25 or CFI-30 fixtures.



RS-240-TT

For Rapid-Start lamps. Economy . . . with quality features.



VAPOR-TIGHT

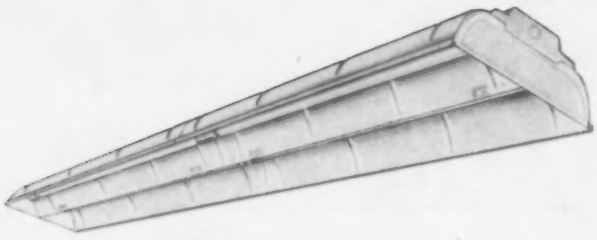
Use where fixtures are exposed to moisture or where non-combustible dust is present. Vinyl gasketed frame. Uses Rapid-Start lamps.

For more facts circle 552 on Reply Card

to improve your plant lighting

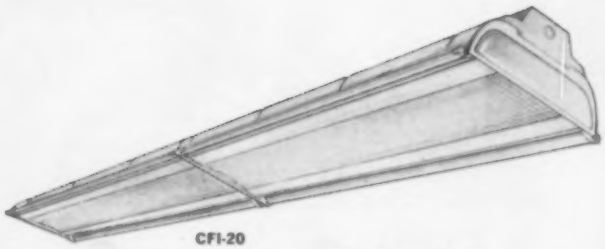
- ☐ Improve morale
- ☐ Reduce employee fatigue
- ☐ Improve housekeeping
- ☐ Impress visitors

the complete Day-Brite line



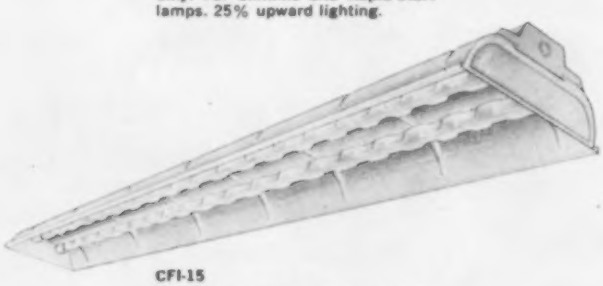
CFI-25

Excellent visual comfort and economy. For Slimline and Rapid-Start lamps. 25% upward lighting.



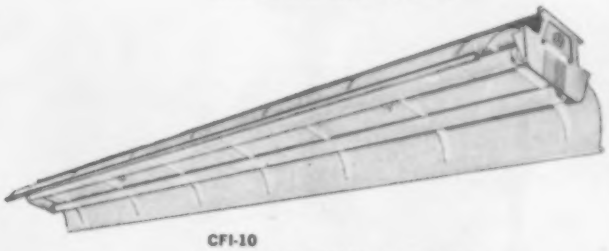
CFI-20

Power-Groove lamps with minimum glare. Cleartex® bottom panel reduces reflection from shiny work surfaces. 23% upward lighting.



CFI-15

For Power-Groove lamps. Closed ends, rigid rib construction. 15% upward lighting.



CFI-10

For Slimline and Rapid-Start lamps. Provides 10% upward lighting through die-embossed apertures.

Get your FREE 16-page "Guide to Modernization and Relighting"

Tells how to estimate your lighting needs for increased production and profit. Includes current recommended illumination levels and photographs of actual modern applications. Write: Day-Brite Lighting, Inc., 6260 N. Broadway, St. Louis 15, Mo.

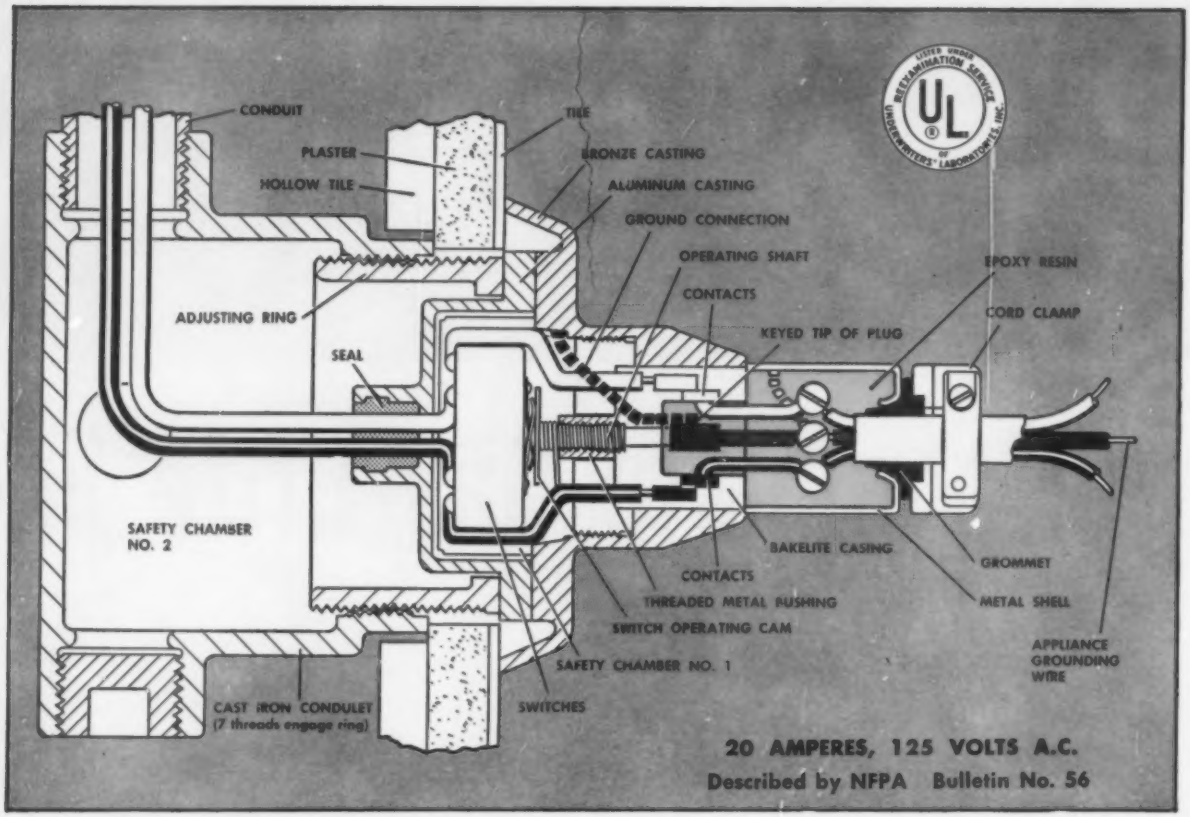
DAY-BRITE®

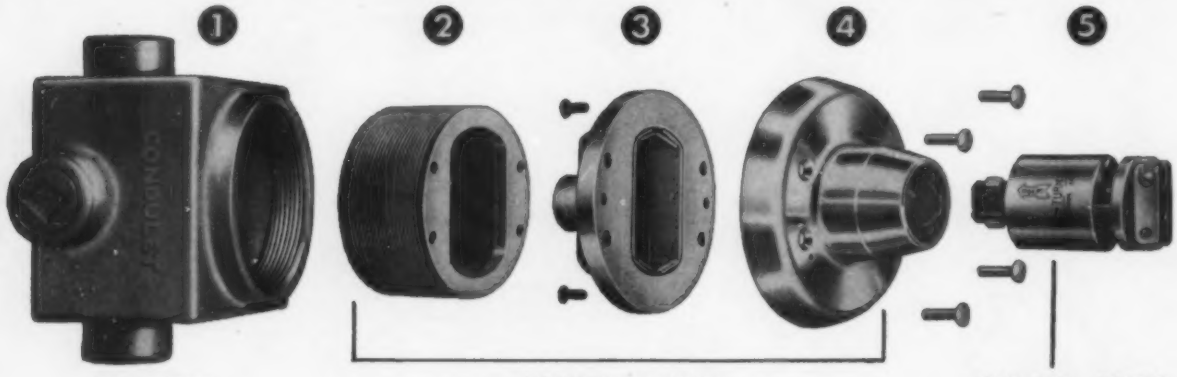
Day-Brite Lighting, Inc., St. Louis, Mo., and Santa Clara, Calif.
In Canada: Amalgamated Electric Corp., Ltd. Toronto 6, Ont.

NATION'S LARGEST MANUFACTURER OF COMMERCIAL AND INDUSTRIAL LIGHTING EQUIPMENT

EXPLOSION

OUTLET AND PLUG PREVENT ARCING





Write for complete information.

Complete explosion-proof unit consists of: (1) No. 24305 shallow or No. 24306 deep cast iron Condulet box. (2) Threaded cast iron adjusting ring for 0" to 5/8" or for 0" to 1¼" adjustment. (3) Cast aluminum safety chamber. (4) Polished chrome-finish bronze casting containing specially keyed "Hubbellock" Explosion-Proof Receptacle. (5) Specially keyed "Hubbellock" Explosion-Proof Cap No. 24312, which is washable, vapor-proof, and waterproof.

- PROOF

IN HAZARDOUS ATMOSPHERES

New Safety for Hospital Operating Rooms and Class I, Group C or D, Industrial Atmospheres

Designed to meet the safety specifications of a leading New England hospital, the new "Hubbellock" Explosion-proof Receptacle and Plug cannot arc when circuits are closed or opened.

These devices establish a new standard of electrical safety in hospital operating rooms and in industrial areas where Class I, Group C or D, atmospheres disqualify conventional wiring devices.

DUAL SAFETY CHAMBER

Current will not flow until a specially keyed "Hubbellock" plug (No. 24312) is firmly seated and locked by rotating it clockwise. This action causes a cam to operate paired microswitches in a casting-enclosed safety chamber.

This chamber connects with a Crouse-Hinds Type CPS Condulet, which forms a second safety chamber to prevent escape of flame into the operating room if gas should ignite in the switching chamber.

VAPOR-PROOF PLUG

Further protection is provided because all air spaces where gases might collect within the plug are filled with a self-hardening epoxy resin, poured in at the time the three-wire cord is fastened to the terminals.

As a result, this vapor-proof plug is also absolutely waterproof. It can be washed without disconnecting it from the cord, so that operating room soilage may be removed without delay.

Strain on the terminals is relieved by rugged cord clamps. A pressure-expanded grommet provides additional sealing.

EXTRA SAFETY FEATURE

Because the receptacle is keyed to accept only this special explosion-proof "Hubbellock" plug (No. 24312), accidental insertion of standard "Hubbellock" plugs is prevented.

However, the explosion-proof plug *will* operate in standard "Hubbellock" receptacles, so that explosion-proof surgical or electrical appliances equipped with the explosion-proof plug may be used in non-hazardous locations if necessary.

ONE-HAND OPERATION

The receptacle is the dead-front type with a spring-loaded shutter. No covers or other mechanical closures are necessary. This permits one-hand connection or disconnection of appliances, which is a great convenience in operating rooms or other hazardous locations.

The receptacle and plug are UL listed for new installations with the Crouse-Hinds Condulet. For modernizing existing wiring, a special mat is provided, and the installation is subject to approval by local inspectors.

Receptacle and plug are described for use in any Class 1, Group C or D, atmosphere by the National Fire Protection Association.

EXPLOSION-PROOF

Hubbellock®

WIRING DEVICES

IT PAYS TO HAVE HUBBELL GOOD CONNECTIONS

HARVEY HUBBELL, INCORPORATED • BRIDGEPORT 2, CONNECTICUT

"HUBBELLOCK" IS A REGISTERED TRADEMARK OF HARVEY HUBBELL, INC. IN CANADA: SCARBOROUGH, ONTARIO

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Your local Moline Chain OFFERS MORE

His engineering staff is capable of helping solve power transmission problems.

Your Moline distributor knows the power transmission business from A to Z, usually has the right answer at his fingertips because his engineering staff has the technical know-how to solve any problem. When you call your Moline man, you know you're talking to an expert and you can rely on his advice and knowledge.

He offers experienced technical help to give you special service.

Most Moline distributors have been in business for many years and have an array of qualified technical men—machinists, gear cutters, installation crews and maintenance men—to help you with special service when you need it.

He maintains a diversified stock of power transmission equipment.

You'll save precious time when you call on your local Moline distributor for power transmission equipment. You don't have to shop around because he normally carries in stock components of every description. His inventory includes bearings, reducers, clutches, couplings, pulleys, takeups . . . virtually any item needed for efficient power transmission.

Find Us Fast In The 'Yellow Pages'

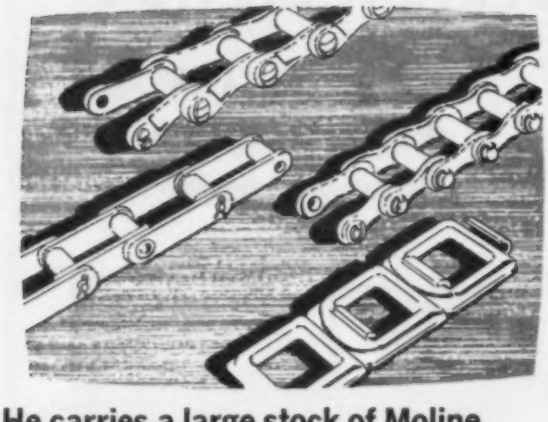
Moline Chains

Leaders for 60 years

for conveying, elevating and power transmission

MOLINE MALLEABLE IRON CO., St. Charles, Illinois

Distributor than "order taker" service...



He carries a large stock of Moline chains, sprockets and buckets.

Your Moline distributor can supply you immediately with chain, sprockets, buckets, sheaves and attachments for any industrial conveyor, elevating or power transmission application. He is always available for help when you need "specials" in malleable chain and attachments because Moline has long been a prime source for OEMs when special chain is required.

He stands ready to give you immediate delivery from stock.

You can rely on fast service when you call your Moline distributor. Tremendous inventories on hand (many distributors stock up to 7,000 power transmission and conveying items) enable him to fill orders and have them on their way within 24 hours. So depend upon your Moline distributor for all your power transmission and conveying supplies and be sure of conscientious service and quality products.

Call your local Moline Chain Distributor today!

ALABAMA, Montgomery, Alabama Bearings Co.; Standard Elect. Mach. Co.; Mobile, Bearing & Trans. Sup.; Turner Sup. Co.; Decatur, H & H Sup. Co.; Birmingham, Industrial Sup., Inc.; Sheffield, Martin Sup. Co.; Brewton, Pensacola Mill Sup. Co.

ALASKA, Ketchikan, Northern Mach. Works, White Motor Co.; Sitka, Sitka Engine & Equip. Co.; Wrangell, Wrangell Mach. Works.

ARIZONA, Flagstaff, Arizona Sup. Co.; Phoenix, Seamon Bearing Co.; Tucson, Seamon Bearing Co.

ARKANSAS, Little Rock, Allied Arkansas Bearing Co., Mill & Mine Sup. Co.; El Dorado, American Sup. Co.; Pine Bluff, Arkansas Mill Sup. Co.; Fort Smith, Boaf Fdry. & Mach. Co.; West Helena, A. S. Kelly Co.

CALIFORNIA, LOS ANGELES, J. W. MINDER CHAIN & GEAR CO.; SAN FRANCISCO, CHARLES A. FOWLER CO.; Fresno, Gordon Equip. Co., George M. Philpott Co.; North Sacramento, Fred E. Barnett Co.; Stockton, Stockton Bearing Co.; Stockton Iron Works, Standard Iron Sup. Co.; Lynwood, Best Chain Co.; Crescent City, Crescent City Mach. Works; El Centro, W. H. Douthitt; San Leandro, Monarch Corp.; Hemet, Steve's Auto Parts; Arcata, Reliable Hardware.

COLORADO, Denver, Allen Bearings Sup., Power Trans. Inc.; Grand Junction, Bearings & Power Trans.

CONNECTICUT, Waterbury, Valley Mill Sup. Co.

DELAWARE, Wilmington, J. C. Bennington Co.; Georgetown, Hemco Dist. Co.

FLORIDA, Fort Pierce, Atlantic Equip. & Sup. Co.; Ocala, H. A. Busbee Co.; Jacksonville, J. G. Christopher Co., C. W. Farmer Co., Georgia Sup. Co., Parker, Helms & Langston, Inc.; Tampa, Ellis Edwin Sup. Co., Bert Lowe Sup. Co.; Mulberry, Florida Conveyor & Equip. Co.; Miami, Gondas Corp.; Winter Haven, Haven Mill Sup. Co., Inc.; Pensacola, Industrial Marine Sup. Co., Pensacola Mill Sup. Co.; Orlando, Mill Sup. Inc.; Lakeland, Miller Bearings, Mine & Mill Sup. Co.; Panama City, Panama Mach. & Sup. Co.

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HAWAII, Honolulu, P. S. Peil Co., Ltd.

IDAHO, Boise, Western Bearings, Inc., Yanke Mach. Shop & Sprocket Co., Inc.; Pocatello, Flaherty Sales Inc.; Wallace, Coeur D'Alenes Co.

ILLINOIS, CHICAGO, HOLMES & JOHNSON, INC., Chain Sales, Inc., Baran Gear & Trans., Patton Gear & Trans. Co., Power Trans. Eq., Republic Bearing & Trans.; Rockford, Berry Bearing Co.; Aurora, Foy Sup., Industrial Sup. Co.; Fairfield, Mid East Sup. & Mach. Co.; Carpentersville, Northern Illinois Sup. Co., Inc.; Woodstock, T. M. Schultz Co.; Streator, Streator Industrial Sup.; Peoria, Hagerty Bros.

INDIANA, Terre Haute, B. F. Crowford Co.; Goshen, Day Equip.

IOWA, Fort Dodge, Fort Dodge Mach. & Sup. Co.; Des Moines, Globe Mach. & Sup. Co.; Davenport, Globe Mach. & Sup. Co.; Spencer, Globe Mach. & Sup. Co.; Cedar Rapids, Globe Mach. & Sup. Co.; Sioux City, Standard Bearings Co.

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MAINE, Bangor, Snow & Nealley.

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MINNESOTA, HOPKINS, R. L. ACTON & ASSOCIATES; Fergus Falls, Empire Sup. Co.; Thief River Falls, Falls Sup. Co.; Minneapolis, Industrial Sup. Co., Inc., Lakeland Engr. Equip., Minnesota Bearing; Austin, Powerite Elec. Motor.

MISSISSIPPI, Jackson, Harper Fdry. & Mach. Co., Mississippi Fdry. & Mach.; Greenville, Jackson Sup., Inc.

MISSOURI, KANSAS CITY, DAVID M. BOATRIGHT, S. D. Calloway Co. Inc., Industrial Bearing & Trans. Co., Noelting Steel Sales Corp., Kansas City Rubber & Belting; Lebanon Sup. Co.; St. Joseph, Wildhagen Mach. & Sup.; **ST. LOUIS, JAMES B. FLAHERTY,** Missouri Elec. Sales & Serv., R. J. Bearing Corp., Carter-Ryco Sales, Inc.; Springfield, Acme Fdry. & Mach. Co.

MONTANA, Great Falls, Carl Weissman & Sons; Missoula, Power Trans.

NEBRASKA, Omaha, Edw. J. Neck & Sons Co., Omaha Gear & Parts; Grand Island, Kelly Sup. Co.

NEVADA, Las Vegas, Reliable Bearing & Sup.

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NEW YORK, New York, R. M. Barwise, Inc., Cangro Trans. Co.; Troy, Bearing Distrs.; Rochester, H. M. Cross & Sons; Bronx, Duane Trans. & Equip. Corp.; Riverhead, Eastern Welding Co.; Hicksville, Long Island Trans. Co.; Buffalo, Mey Chain Belt Co., Power Drives, Inc.; Syracuse, Sawyer Engr. Co., Syracuse Bearing; Albany, Transmatic Equip. Co.; Elmira, Harold Van Ausken Mill Sup.; Lockport, Ward Bros. Mill Sup. Co.

NORTH CAROLINA, Lenoir, Blue Ridge Hardware & Sup. Co.; Statesville, Bryant Sup. Co., Tri-State Distrs., Inc.; Gastonia, Bryant Sup. Co., Gastonia Mill Sup. Co.; Rocky Mount, Carolina Mach. & Sup. Co., H & S, Inc.; Kinston, Carolina Mach. & Sup. Co.; New Bern, Craven Fdry. & Mach. Co.; Mount Airy, Currier-Withers Sup. Co.; Raleigh, Elect. Equip. Co.; Wilmington, General Sup. Co., Mill & Contractors Sup. Co., Wilmington Iron Works; Lexington, General Trans. Sup., Roanoke Rapids, Industrial Distrs. Inc.; Charlotte, Industrial & Textile Sup. Co., Henry Walke Co.; High Point, Kester Mach. Co.; Winston Salem, Kester Mach. Co.; Greensboro, O'Dell Mill Sup. Co.; Shelby, Shelby Sup. Co., Inc.; Burlington, Sykes Sup. Co.

NORTH DAKOTA, Fargo, Empire Sup. Co.; Jamestown, Empire Sup. Co.; Bismarck, Empire Sup. Co.; Grand Forks, Grand Forks Sup.; Minot, Minot Sup. Co.; Williston, Williston Sup. Co.

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OKLAHOMA, Tulsa, Allied Bearings Sup., Clark Bearing & Sup. Co.; Chickasha, Chickasha Gin & Mill Sup.; Oklahoma City, Dagwell-Dixie Co., Equipment Sales, Power Equip. Inc.; Muskogee, Pale Indust. Sup.

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RHODE ISLAND, Providence, James A. Starck.

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TENNESSEE, MEMPHIS, MALCOLM S. CONE CO., Dabney-Hoover Sup. Co., Lewis Sup. Co.; Nashville, Industrial Sales Co., Inc., Keith-Simmons Co., Inc.; Jackson, Motor Parts & Bearing Co.; Chattanooga, Noland Co., Inc., Volunteer Bearing & Trans.; Knoxville, Browning Belting & Sup. Co., Industrial Belting & Sup. Co., W. Savage Co.

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UTAH, Salt Lake City, All Trans. Prods., Power Trans. Sup.

VERMONT, St. Johnsbury, Reed Sup. Co.

VIRGINIA, Bassett, Blue Ridge Hardware & Sup. Co.; Martinsville, Blue Ridge Hardware & Sup. Co.; Lynchburg, J. C. Ferebee Co., Ferebee-Johnson Co., Inc.; Roanoke, Graves Humphreys' Inc.; Waynesboro, Mize Sup. Co.; Petersburg, Tom Norton Co.; Richmond, Southern Railway Sup. Co.; Norfolk, Taylor Parker Co., Henry Walke Co.

WASHINGTON, SEATTLE, CHAIN GEAR, INC.; Spokane, Empire Bearing Co., Butt-Moseler Co.; Everett, Greenshield's Indust., Power Trans. Sales; Tacoma, Reel Mach. Co.; Bellingham, Schuman Steel Prod. Inc.; Mount Vernon, Trans-Bearing Co.; Longview, Longview Equip.

WEST VIRGINIA, Bluefield, Bluefield Hardware Co.; Charleston, Capital City Sup. Co.; Logan, Guyan Mach. Co.; Elkins, Valley Mill Sup. Co.; Huntington, Wall Conveyor & Mfg. Co., Banks-Miller Sup. Co.

WISCONSIN, Green Bay, Libert Bearing; Madison, Richard E. Ela Co.; Wausau, Sysberg Indust. Sales; Milwaukee, Equipment Specialty Co.

CANADA, Vancouver, Victoria, Western Equipment Ltd.; British Columbia, Bennetts Ltd., Okanagan Equip. Ltd.; Alberta, Electrical Ind. Ltd., Electrical Cont. & Mach. Co. Ltd., Oliver Chem. Co. Lethbridge Ltd.; Saskatchewan, Bearing & Trans. Supply, Tractor Repair Parts Co.; Manitoba, Cuthbert Co. Ltd.

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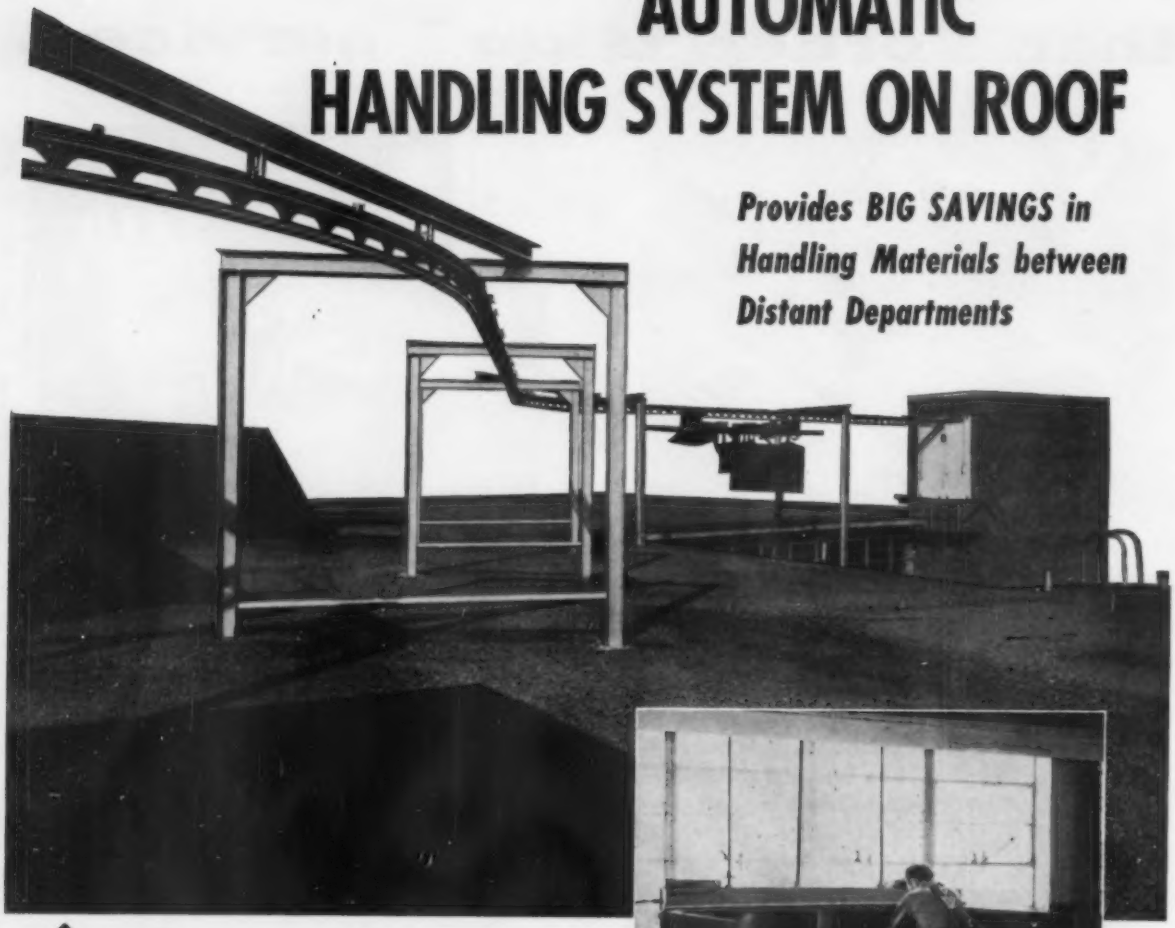
AUTOMATIC HANDLING SYSTEM ON ROOF

Provides BIG SAVINGS in Handling Materials between Distant Departments



The Tramrail carrier seen here is approaching one of the penthouses built at each end of the track. The penthouse doors open and close automatically as the carrier passes through. The load lowers to the floor inside.

Loading Tramrail freight van inside building. At a touch of a button, it hauls heavy loads long distances, day or night, through heat or cold, rain or shine, dependably, at low cost.

NEARLY every plant has thousands of square feet of idle roof area, yet their working areas may be starved for floor space.

Using the roof for materials handling by means of an automatic Cleveland Tramrail system can be a big help in relieving a crowded plant. And the roof need not be flat. Even a saw-tooth or gabled roof can be used to support a Tramrail track.

The automatic system illustrated here brought about tremendous savings. It, in effect, joined two factory departments and enabled as efficient an operation as though they were physically adjacent. It reduced the handling cost to the barest minimum because the Tramrail carrier shuttles back and forth without need of attendants. It eliminated other overhead expenses.

Cleveland Tramrail engineers have had wide experience in the design and application of automatic materials handling systems and will be happy to discuss ways of helping you without obligation.

Write for free "Automatic Handling" Booklet.

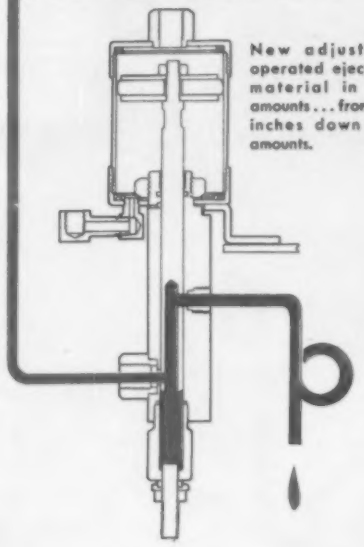
CLEVELAND TRAMRAIL

Overhead Materials Handling Equipment

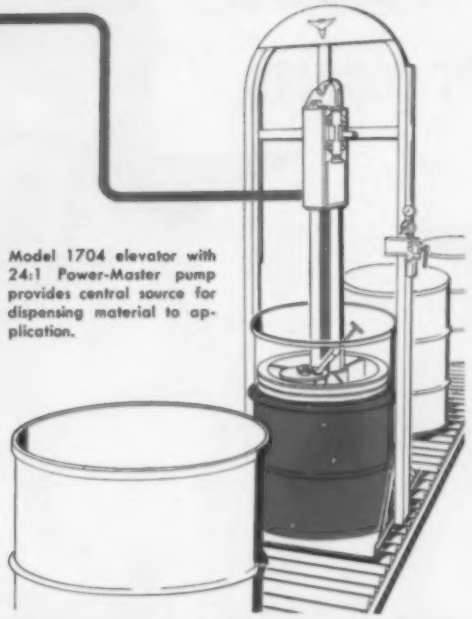
CLEVELAND TRAMRAIL DIVISION • THE CLEVELAND CRANE & ENGINEERING CO. • 7551 E. 290 St. • WICKLIFFE, OHIO

For more facts circle 555 on Reply Card

New ideas for dispensing materials...from LINCOLN



New adjustable air-operated ejectors deliver material in measured amounts... from 0.2 cubic inches down to minute amounts.



Model 1704 elevator with 24:1 Power-Master pump provides central source for dispensing material to application.

New technique...welding with adhesives

AIRMOTOR SIZE		2" ONE THIRD THE POWER OF THE 6"	3" ONE HALF THE POWER OF THE 6"	4"	6" TWICE THE POWER OF THE 6"
PUMP DESIGN					
SHOVEL TYPE THREE SIZES	A	25··1	37··1	75··1	····
	B	13··1	20··1	40··1	80··1
	C	8 ··1	12 ··1	24··1	48··1
BALL TYPE TWO SIZES	D	4 ··1	6 ··1	12 ··1	24··1
	E	1.3··1	2 ··1	4 ··1	8 ··1

Major automobile manufacturers now "weld" with adhesives . . . join hood and trunk assemblies with measured daubs of thermosetting mastics that adhere strongly to metal and won't slump during paint bake exposure. The "adhesive welds" save weight, prevent surface dimples caused by electric welds, absorb vibrations, and eliminate the need for asphaltic paper or other sound deadeners.

Lincoln offers complete versatility in materials dispensing equipment as shown in the pump chart at left. Simply by changing air motors or pump tubes, you get pressure ratios from 1.3:1 to 80:1. You can dispense precise amounts from gallons to ounces with Lincoln equipment.

Investigate how you can improve your production use of materials with Lincoln dispensing systems.

LINCOLN ENGINEERING COMPANY
Dept. PE-1
4010 Goodfellow Blvd.
St. Louis 20, Mo.

☐ Send literature on materials dispensing equipment
☐ Have local man call to discuss dispensing systems

Name_____ Title_____

Company_____

Street_____

City_____ Zone____ State_____

Industry's widest selection of materials dispensing equipment: Air-operated pumps • Measuring valves • Pressure primers • Airless spray equipment • Hose • Couplings • Air compressors • Filters • Regulators

16101

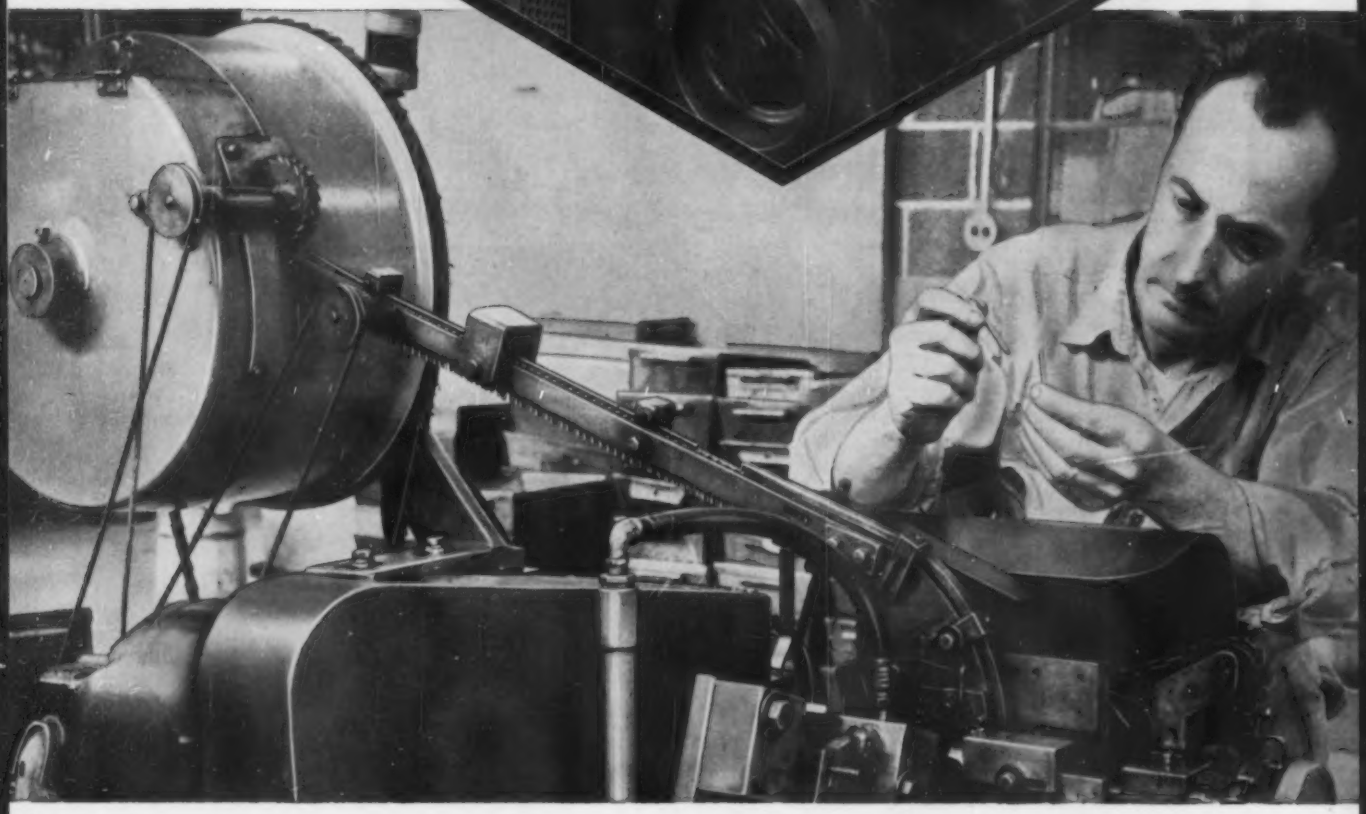
LINCOLN
ENGINEERING COMPANY

ST. LOUIS 20, MO. • DIVISION OF THE McNEIL MACHINE & ENGINEERING CO.,

For more facts circle 556 on Reply Card

One good Le Roi leads to another ...user reports

One of the machines served by the Le Roi 75S2 is the rivet drilling machine. The operator is shown gauging one of the drilled tubular rivets prior to finishing.



LE ROI 75-HP STATIONARY COMPRESSOR

First air-cooled Le Roi finishes 5 years of service with just routine cleaning and oil changes!

Shown above is a Le Roi 75S2 compressor recently installed at John Hassall, Inc., Westbury, Long Island, manufacturer of job-designed fasteners and parts.

Picking Le Roi came naturally when Hassall found need for additional air power. Their last Le Roi has worked for five years without trouble, and has required only filter cleaning and oil changes for upkeep.

Hassall was convinced they could save 30% on installation, get more air from less space, and reduce maintenance time about 40% if they installed the air-cooled Le Roi 75S2 rather than a water-cooled air compressor.

Moreover, Le Roi compactness permits installation *near the point of use*, with less piping and air loss. Air-cooling eliminates costly plumbing and water-line freeze-ups . . . permits indoor or outdoor installation. Dual control gives you constant speed or automatic start-stop operation.

Pick Westinghouse unit-type or Le Roi stationary air compressors for your needs. Sizes from ½ to 100 hp. See your Le Roi distributor, or write to Le Roi Division, Westinghouse Air Brake Co., Sidney, Ohio.

SC-07

LE ROI STATIONARY COMPRESSORS

PORTABLE AND TRACTAIR® AIR COMPRESSORS • STATIONARY AIR COMPRESSORS • AIR TOOLS

For more facts circle 557 on Reply Card

COURT DECISIONS —a summary of legal findings of interest to the plant engineer

Prepared by Albert Woodruff Gray

Employment Contract Arbitration

CONTRACT MADE by a New Jersey company with an employee contained the provision, "Any controversy or claim arising out of or relating to this agreement or the breach thereof, shall be settled by arbitration in accordance with the rules of the American Arbitration Association, and judgment on the award rendered may be entered in any court having jurisdiction thereof."

Attempt was made to discharge this employee on the ground that he was physically and mentally unable to perform his work as an employee. The dispute was submitted to the American Arbitration Association which made an award in favor of the employee.

The employer then brought a suit for breach of contract, and the employee asked that the action be stayed and an order made directing the submission of this second dispute to arbitration. This stay was granted by the court with the comment,

"Where the parties incorporate an arbitration clause in their agreement, the courts will enforce a timely request by either party that the other be compelled to have the arbitral question in dispute adjudicated by the arbitration process agreed upon and refrain from substituting the judicial forum for the arbitrator as the adjudicator of such issues.

"To accomplish this result the contract need do no more than provide in substance that disputes arising thereunder shall be arbitrated. The employee had the right upon satisfying the court that the disputed issue was arbitrable, to a stay of the action until arbitration should be had in accordance with the agreement." Court brief, 160 Atl. 2d 505, New Jersey, May 2, 1960.

Professional Skill Implied

UNDER A contract for drilling, casing and testing a well, the work was to be performed by a rotary drilling outfit and the well drilled to a depth not exceeding 300 ft with the option in the owner to stop further drilling at any point below 200 ft.

All labor, tools, machinery and 250 ft of arc welded casing were to be furnished by the contractor. A further provision of this agreement was, "The contractor does not agree to find water but he does agree to drill any well called for herein in a good and workmanlike manner. When the drilling reached 290 ft work was stopped by the owner.

Under his agreement the contractor had earned $1555.93 which the owner refused to pay, contending that the work had been improperly performed, that had the drilling been correctly done the well would have produced over 1200 gpm at a pumping level of 50 ft "but that by reason of poor workmanship in drilling and working the well, the well failed and still fails to produce more than 600 gpm at a pumping level of 135 ft."

A verdict for the amount claimed was rendered the driller. The appellate court sustained the verdict. In so doing, the court said that the law implies that every contract must be performed with care and skill. Such rule, the court added, is universally adopted in relation to the activities of all persons holding themselves out as skilled and experienced in performance of the particular work under consideration. This feature, the court asserted, had been here fully met and the owner was justly indebted to the well driller for the amount. Court brief 130 Pac. 2d 477, California. November 4, 1942.

"More or Less"

PURCHASE ORDER for steel to be used in the construction of a catalytic cracking unit read in part, "Under our order for furnishing the following material—one lot of steel and connectors for pipe supports in accordance with drawings furnished, approximately first 30 tons at 32¢ per lb, $19,200.00: approximately 95 tons at 30¢ per lb., $57,000. Total 125 tons, more or less, approximately $76,200."

Only 52 tons were used for the job and the buyer refused to purchase any more than what it needed according to the specifications and drawings. The seller contended that the order demanded 125 tons and brought suit against the purchaser for the loss of profit.

The court ruled in favor of the purchaser, saying, "Where the buyer purchases a specific amount of material to be used for no particular or specific purpose, as where a retail merchant purchases merchandise to be retailed to his customers, generally, the quantity specified controls, with slight variations.

"But where the purchase is for material to be used for a definite purpose or specific project, all of which facts are made known to the seller, then the amount of material required to complete the specific project becomes the essence of the contract rather than the specifications wherein a certain amount of material is designated more or less." Court brief 189 Fed. 2d 629, Oklahoma, June 11, 1951.

Promotion Secrets

A SELLING scheme called "Cash Surprise Bonus Cards" was offered to a Texas store owner as a promotion feature. After some negotiations these cards, intended to be punched by a store checker in an amount corresponding to a purchase and entitling the customer ultimately to a prize, were purchased by the store owner. However, he was refused cards for use in a nearby city as that privilege had been granted by the card manufacturer to a competitor of this store owner.

Shortly afterwards these cards were released by this competitor and the first store adopted a scheme substantially the same as that which it had already purchased, called "Cash Circle Cards."

Thereupon the store was sued by the originator of these cards for an injunction against its further disclosure or use of this premium scheme, which was asserted to be a trade secret. In its refusal of an injunction, the Texas court said, "There must exist a substantial element of secrecy and the term 'trade secret' is not applied to matters of public knowledge, or of common knowledge to a trade or of general knowledge in an industry or to matters which are completely disclosed by the goods which are marketed."

Grounding its conclusion on this statement of the law, the court added, "Here of course the cards were complete on their face and were certainly for and in use by the general public. We therefore hold that the cards here involved as constituted and sold, did not come under the heading or meet the requirements of that which is a trade secret." Court brief 338 S.W. 762, Texas, August 3, 1960.

Errors of Engineers

ENGINEERS WERE consulted by the owners of a garage in the preparation of the necessary plans and specifications for the installation of a heating system that would maintain the heat at 70 F in the building.

Plans were prepared and the contract

COURT DECISIONS

for the installation awarded a contractor. After the installation of the system, however, it proved inadequate to maintain the stipulated degree of temperature. A survey of these plans disclosed an error which, through the preparation of supplementary ones and new specifications, overcame this defect but at an additional expense to the owner of $1403.

In awarding the owner this amount of damages, the court said, "Compensation is a basic principle of damages. For breach of contract the injured party is entitled to be compensated for losses which are the natural consequence and approximate result of the breach. The purpose of such compensation is to place the injured party in as good a position as that in which full performance would have placed him. He is not entitled because of a breach to be put in a better position than he would have been had the contract been fully performed." Court brief 78 Atl. 2d 387, District of Columbia.

Volunteered Services

PREPARATION OF the layout for the installation of an air conditioning unit together with the necessary ducts and registers was made as an accommodation by a dealer. Unfortunately the plans were defective and suit was brought against the dealer for damages for negligence in his preparation of the plans.

Sustaining the right of the owner to a recovery irrespective of whether the plans and specifications were or were not gratuitous, the court said, "It is ancient learning that one who assumes to act, even though gratuitously, may thereby become subject to the duty of acting carefully, if he acts at all.

"Whether this service was purely gratuitous or a service supplied in connection with the sale of the unit is open to question, but the dealer cannot escape liability for its negligence by the mere showing that its services were gratuitous." Court brief 143 Atl. 2d 98, District of Columbia.

"A-1" Condition

IN BUYING A second-hand tractor, the purchaser told the salesman that he knew nothing of this kind of tractor and that he must rely entirely on the salesman's judgment. Assured by the salesman that the tractor was in 'A-1' condition, the customer bought and paid for the tractor.

Later this purchaser sued to recover his money on the ground that not only had there been a breach of warranty but that the representations of the salesman had been fraudulent. The seller, in his defense, relied on a stipulation in the sales agreement that there was no express warranty of the tractor and that any implied warranty was waived by the buyer.

Judgment for recovery of the money was awarded the purchaser by an Arkansas court with the statement, "In the circumstances of this case, where the purchaser was paying a very substantial sum amounting to about 40 per cent of the price of a brand-new tractor, we do not regard the seller's representation as a mere expression of opinion and therefore not actionable. A representation that a used tractor was in 'A-1' condition has been held to be a statement of fact and hence a warranty rather than a mere expression of opinion." Court brief 339 S.W. 2d 101, Arkansas, October 17, 1960.

Collateral Agreement

INCLUDED IN A subcontract for the installation of plumbing in a school at Greenwich, Connecticut, was the installation of a sprinkler system. But in the alternate proposal it was provided that if this alternate was accepted, the sprinkler system should be omitted.

However, under an oral agreement with the general contractor, the subcontractor was to be reimbursed for this installation if the Board of Education paid the general contractor for such installation as an extra. Later the general contractor collected for this installation as an extra but refused to pay the subcontractor according to this oral agreement on the ground that the entire contract of the subcontractor, irrespective of the alternate, was included in the contract of the general contractor, which had provided for this installation.

"The written subcontract, to the extent that it did not show how payment for the sprinkler system, if one was installed, was to be made," said the court in its decision in favor of the subcontractor's suit against the general contractor, "was not the sole repository of the final agreement between the parties. Under the circumstances it was competent for the parties to deal with the question for payment of the sprinkler system by a contemporaneous agreement." Court brief 164 A. 2d 405, Connecticut, July 26, 1960.

Dealers Association Fined

AN INDICTMENT was returned by the grand jury against an automobile dealers association, charging that the association and others were engaged in a combination or conspiracy to stabilize the retail price of specific motor cars and accessories, thus effecting an unreasonable restraint of trade.

This association had published and circulated among its members a printed price list that was used by dealers in the making of sales agreements. The list was shown to customers as evidence of an established retail price. This published price, however, was set at a high level in order that a more liberal trade-in allowance could be made.

Sustaining the fine of $5000 imposed by the trial court, it was said on this appeal, "A combination or conspiracy formed for the purpose and with the effect of raising, depressing, fixing, pegging or stabilizing the price of a commodity in interstate commerce is unreasonable in itself under the Sherman Act.

"The test is not what the actual effect is on prices but whether such agreements interfere with the freedom of traders and thereby restrain their ability to sell in accordance with their own judgment." Court brief 279 Fed. 2d 128, California, May 26, 1960.

Satisfactory Completion

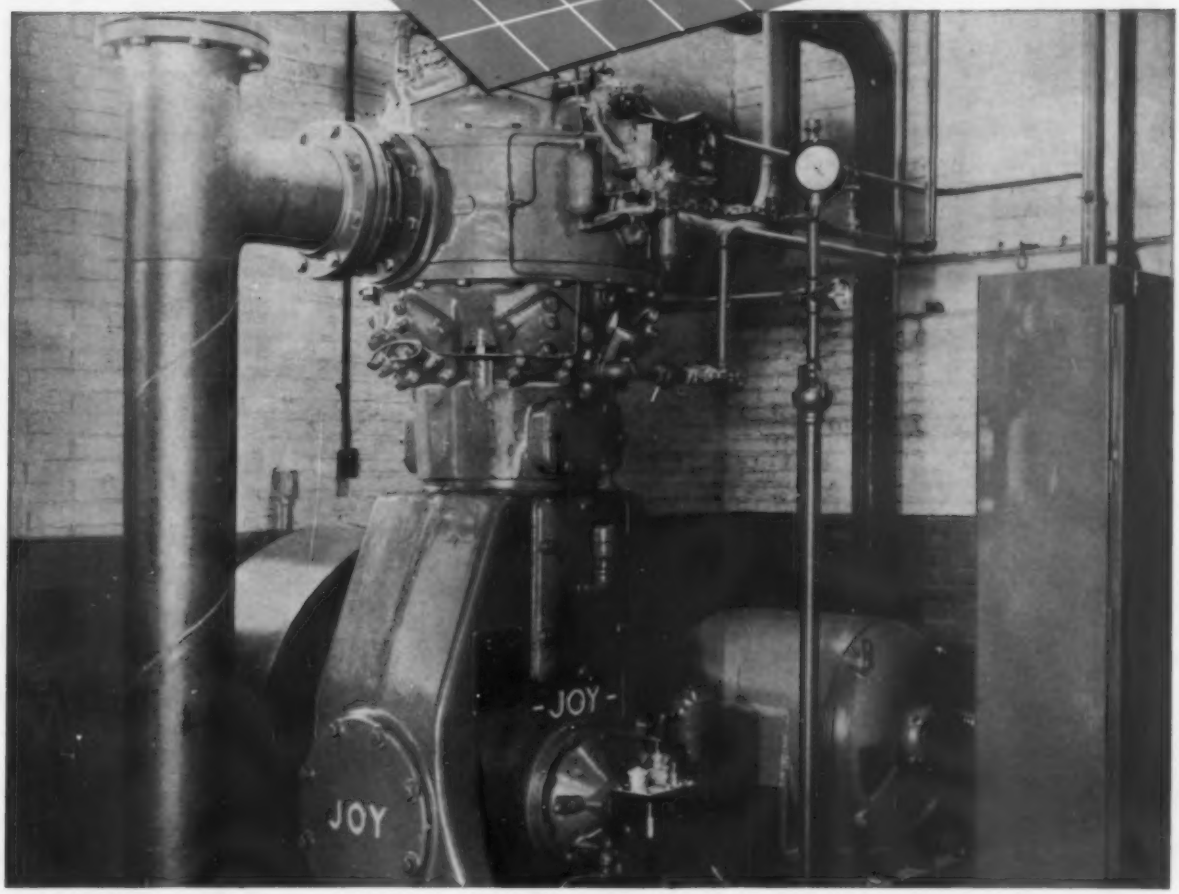
UNDER AN agreement for the purchase of a house still under construction, $3000 of the purchase price was placed in escrow to be held until the "satisfactory completion of the work." When the work was completed and the purchaser had moved in, he refused to release the $3000, saying that he was not satisfied with the work.

Of agreements for the performance of work satisfactory to another, the court said that one class of such contracts comprises agreements to perform services that are done in an effort to please the taste, fancy or sensibility of the one for whom performance is rendered. In cases of this character the one for whom the work is to be performed is the sole judge and he may either give or withhold his approval.

"The other cases are those that involve satisfaction in such things as operative fitness, mechanical utility or structural completion in which personal taste plays little or no part.

"In such instances, with the standard the usual attitude of a reasonable man, the party for whom the work is performed has no arbitrary privilege of refusing to admit his satisfaction and cannot withhold his approval without a reasonable justification. If in the light of such standards," said the court, "the work of the contractor met the approval of reasonable and prudent men, which it does, it is sufficient." Court brief 328 Pac. 2d 307, Utah, July 18, 1958.

A 150 Horsepower Compressor in just 35 Square Feet of Floor Space . . .

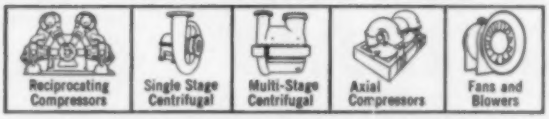


the JOY WG-9 Vertical Compressor

You can make full use of the space *above* the floor when you specify a Joy WG-9 vertical compressor. Thousands of these heavy-duty units have been installed in existing spaces which were too small for other compressors of comparable capacity.

Joy WG-9's are the only machines in their field offering so many "big compressor" features—replaceable cylinder liners and crosshead guides, anti-friction main bearings that never require adjustment, full force-feed lubrication of all working parts. These heavy-duty features mean dependable performance year after year. Eighteen standard models are available in a range from 15 to 150 horsepower, plus special models for high and low pressures and oil-free operation. One of them is just right for your next plant expansion. Get complete details by writing for bulletin **2414-15.**

AIR MOVING EQUIPMENT FOR ALL INDUSTRY



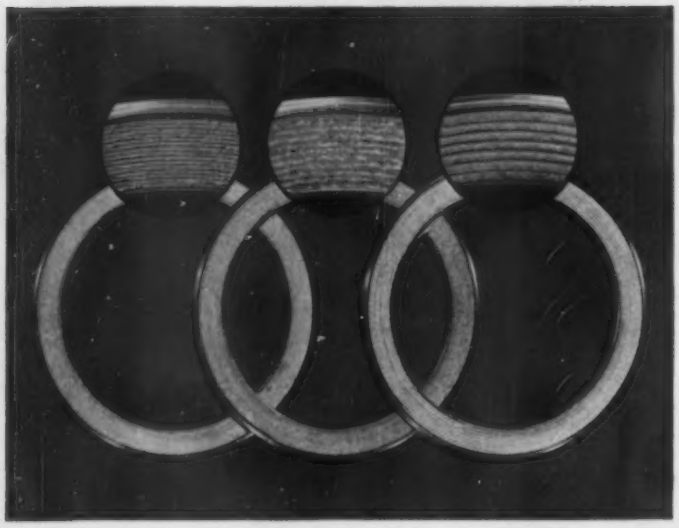
JOY

Joy Manufacturing Company
Oliver Building, Pittsburgh 22, Pa.

In Canada: Joy Manufacturing Company (Canada) Limited, Galt, Ontario

For more facts circle 558 on Reply Card

ENGINEERED GASKETS for Plant Maintenance



Exacting control of gasket density is obtained by varying the number of metal plies and filler material to seal a specific pressure.

Controlled density is the reason why Garlock *Guardian Gaskets offer you unusual sealing ability.** A series of V-shaped metal plies alternated with layers of filler form the "body" of GUARDIAN spiral-wound gaskets. The proper selected thickness of filler material and preformed metal, the number of laminations of filler and metal and the correct tension of filler and metal while being formed into a gasket are factors engineered to achieve the proper gasket density.

This controlled density—combined with the special V-shaped metal plies—allows the gasket to "breathe." Thus, a tight seal is effected at all times despite equipment or line expansion and contraction. In no other type of gasket is it possible to vary the compressibility to meet different pressure and bolt load requirements.

Complete range of sizes, and shapes and wide temperature range is another reason for specifying Garlock GUARDIAN Gaskets . . . $\frac{1}{16}$" thickness up to 6", $\frac{1}{8}$" up to 30", .175" up to 60" and $\frac{1}{4}$" thick up to 60" depending on flange width. For temperatures up to +1900°F. with ceramic filler material.

Type CR GUARDIAN Gaskets are furnished with a cadmium plated centering ring for corrosion resistance and prolonged shelf life. Centering ring also is marked with the pressure series —assuring application of correct gasket density for specific pressure.

Convenient local stocks of most standard sizes are maintained at Camden, New Jersey, Cleveland, Ohio, Houston, Texas and San Francisco, California, for quick delivery.

GARLOCK

Find out more from your Garlock representative at the nearest of the 26 Garlock sales offices throughout the U. S. and Canada, or write for catalog AD-176, Garlock Inc., Palmyra, N. Y.
Canadian Div.: Garlock of Canada Ltd.
Plastics Div.: United States Gasket Co.

Order from the Garlock 2,000... two thousand different styles of Packings, Gaskets, Seals, Molded and Extruded Rubber, Plastic Products.

*Registered Trademark

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A FABLE ON FLOORS . . .

1. No matter what type of floor you install . . .

2. Wear takes place at the surface.

3. For the most wear-resistant floor surface . . .

4. A surface that will withstand abrasion, impact, point loads, oil absorption, leaks, spalling, dusting . . .

5. "Iron-Armour" the surface with MASTERPLATE . . . and conquer your flooring problems!

ADJOINING FLOORS
Plain Concrete Floor
Surface worn out, replaced after 8 years.
MASTERPLATE Floor
Surface in good condition after 12 years.

6. Compare the wear—adjoining floors . . . same heavy traffic on both.

MORAL: Win the battle of industrial floor wear . . . assure 4 to 8 times longer floor life by installing . . .

FREE 16-PAGE BOOKLET . . . with full details on applications, advantages and specifications for MASTERPLATE iron-armoured metallic aggregate floors. Write for your free copy.

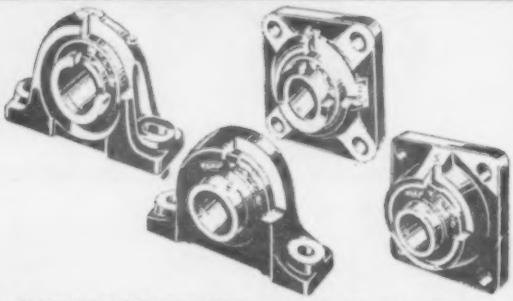
MASTER BUILDERS. MASTERPLATE*

*MASTERPLATE is a registered trademark of The Master Builders Co. for its specially-prepared, metallic aggregate for producing "iron-armoured" concrete floors.

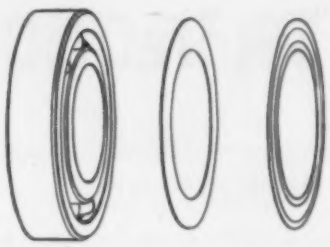
The Master Builders Company • Division of American-Marietta Company • Cleveland 18, Ohio
World-wide manufacturing and service facilities

For more facts circle 560 on Reply Card

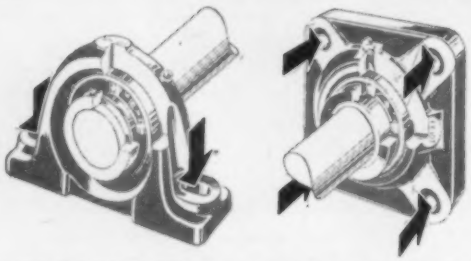
DISTRIBUTOR DAN, the SKF bearing man, shows how SKF PILLOW BLOCKS AND FLANGED MOUNTINGS eliminate 5 pesky maintenance problems



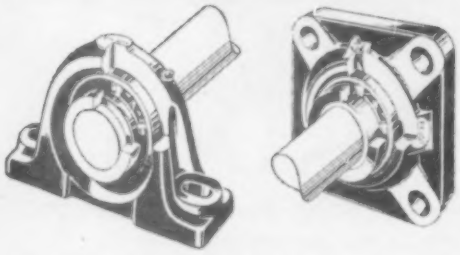
NO MORE FOOLING WITH FITS because SKF makes 27 sizes of unit pillow blocks for shafts ranging from ¾" to 4" dia.—and flanged mountings for 24 shaft sizes from ¾" to 2 15/16" dia. Most sizes are available with set screw or eccentric locking collars.



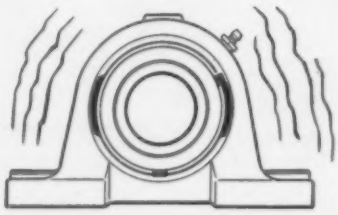
SOLVES SEALING PROBLEMS. Both units are prelubricated and equipped with seals that really seal. The red washer is made of tough, durable DuPont "Fairprene"—backed by a sturdy metal plate. Rotating flinger actually flings dirt away from the bearing.



EASILY INTERCHANGEABLE. You can quickly substitute SKF units for other worn-out or damaged mountings. Bolthole spacing and center heights are designed so that the units can be interchanged with other mountings of similar design.

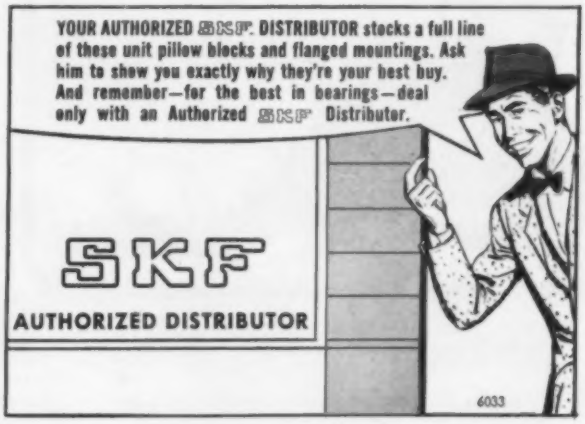


MOUNTING MADE EASY. You can install these pillow blocks and flanged mountings in minutes! Because, the spherical outer ring provides easy initial alignment—compensates for misalignment. Separate locking collar and set screws ensure fast adjustment.



RARELY NEED REPLACING. SKF Unit Pillow Blocks and Flanged Mountings are competitively priced. Yet their cast one-piece housings last longer—withstand all types of shock and abuse. Units rarely need relubrication or replacing.

YOUR AUTHORIZED SKF DISTRIBUTOR stocks a full line of these unit pillow blocks and flanged mountings. Ask him to show you exactly why they're your best buy. And remember—for the best in bearings—deal only with an Authorized SKF Distributor.

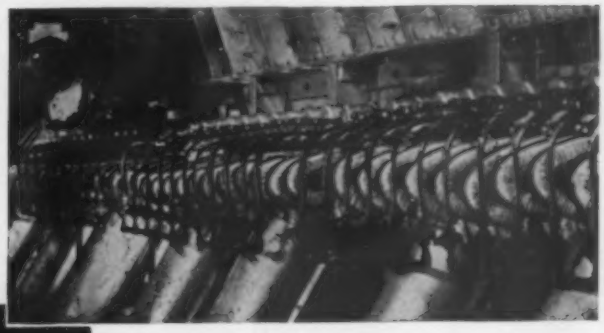


SKF MOTION ENGINEERING

Advanced ball and roller bearing technology

For more facts circle 561 on Reply Card

SAVE ON REPLACEMENT of valves, fittings, flanges by applying flexible connectors to pressure lines.



SAVE ON BREAKDOWNS, LOST MAN HOURS due to pipe motion in conveying high temperature media. Use metal hose.

METAL HOSE SAVES MONEY

. . . and will for you, in hundreds of places throughout your plant. Your Flexonics PMS Distributor can show you these money-saving applications.

SAVE TIME, INCREASE EFFICIENCY by using metal hose as a vacuum or exhaust line on standard or special production jobs.

SAVE INSTALLATION COSTS, avoid damage by using metal hose in confined piping space.

Every Piping Problem . . . from pump shaft bearing wear to valve and pipe fitting failure can be prevented *readily* with the proper application of metal hose. Thermal expansion and contraction . . . vibration and shock . . . the problem of piping in confined areas—all can be answered with metal hose. Your Flexonics PMS distributor is a Pipe Motion Specialist . . . let him appraise your pipe motion problems and discuss practical improvements with you. He carries a complete stock of metal hose and fittings . . . can fabricate complete assemblies to your requirements.

FLEXONICS DISTRIBUTOR **PMS** PIPE MOTION SPECIALIST

Flexonics

FLEXONICS CORPORATION • BARTLETT, ILLINOIS
In Canada: Flexonics Corporation of Canada, Ltd., Brampton, Ontario

METAL and SYNTHETIC HOSE
EXPANSION JOINTS
BELLOWS • SPECIAL TUBULAR ASSEMBLIES

SUBSIDIARY OF CALUMET & HECLA, INC.

ATTACH TO YOUR LETTERHEAD

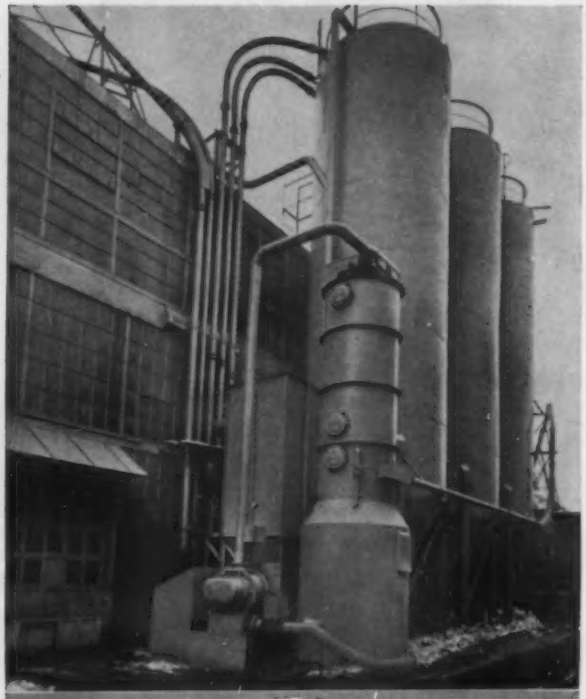
Flexonics Corporation
400 East Devon
Bartlett, Illinois

Send free copy of
Flexonics Metal Hose
Product and Design Guide. Also send the name of your local distributor.

DI-460

For more facts circle 562 on Reply Card

One man and this Airstream Conveyor pushed costs down at Wehr Steel Co. Compact system moves bulk foundry materials from railroad cars to storage, later transfers them to process.



PUSH COSTS DOWN....

move up to modern handling

look how these

foundries cut costs with Dracco Airstream Conveyors

Major automotive foundry saves $32,000 a year in labor costs! Airstream Conveyor unloads core binders 400% faster than manual methods, moves them at 20 tph to eight storage bins without intermixing.

Wehr Steel Co., Milwaukee, realized multiple cost savings with its Dracco Airstream Conveyor. Bulk buying cut bentonite costs over $12,000 a year, reduced sand and other material costs $3-$5 a ton. Bulk handling slashed labor costs 50%.

Large aluminum foundry by-passes costly handling by air conveying sand from railroad cars to 100-ton silo at 10 tph. Labor required: one man. Cost of bags: eliminated. And there is no dust, waste, safety hazards or expensive maintenance.

Kelsey-Hayes Co., Detroit, air conveys seacoal and bentonite to mulling stations. One man with a push button-controlled Airstream system pushes costs down here, assures 100% material usage with no dust or waste.

Modernized bulk handling with Dracco Airstream Conveyors introduces improved productivity at lower cost. Savings result from bulk buying, less labor, faster handling, cleanliness, safety and simplified maintenance. Why not include a Dracco Airstream Conveyor in your cost reduction program?

For expert assistance when you move up to modern handling, contact: Dracco Division of Fuller Co., Harvard Avenue and East 116th Street, Cleveland 5, Ohio.

Write today for further information. Ask for 32-page Bul. 530, "Dracco Airstream Conveyors".

DRACCO *airstream* conveyors
dust control equipment

FULLER COMPANY

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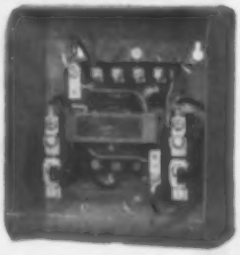
QUICK COIL CHANGE

EASY CONTACT CHANGE

Putting it Bluntly... No Other Magnetic Starter is This Easy to Maintain

In just 10 seconds you can inspect contacts of the General Electric magnetic starter (left photo). You don't even need a screwdriver. Just remove two coil retainers, and lift out entire magnet and movable contact assembly. Also you can convert movable contacts from normally open to normally closed without tools (center), and fixed contacts by removing just one easily accessible screw per contact. Coil change also takes less than a minute (right). You can start benefiting now from these "easy maintenance" features of G-E magnetic starters. Just ask your General Electric sales engineer or distributor, or write for Publication GEA-7020. General Electric Co., Section 813-31, Schenectady, N. Y.



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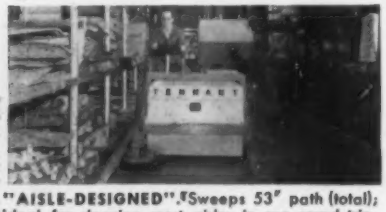
World's most advanced Power Sweeper

The all-new Tennant "85"

Practically perfect dust control!

HUGE ENCLOSED FILTER (9620 sq. in.) has 3 times the filtering area of any other industrial sweeper.

BIG 16" WHEELS provide good traction, absorb shock; allow easy travel over rough areas.



"AISLE-DESIGNED". Sweeps 53" path (total); ideal for cleaning most aisles in one round trip.

Here's a *truly modern* sweeper . . . one with many features never offered before.

NEW. Constant-speed fan, side brush, and main brush. Powered so speed of rotation is constant regardless of travel speed. Sweeps equally clean at slow or fast speeds.

NEW. Giant enclosed filter gives virtually dust-free sweeping . . . *anywhere.*

NEW. Floating brush suspension; brush automatically follows uneven surfaces.

NEW. Pull-through vacuum system; removes dust *before* it goes through fan.

NEW. Lower silhouette. Operator sits safely at rear, where he can see side brush without strain.

NEW. Filter-shaker discharges dust into hopper at the touch of a button.

Heavy-Duty. All-welded frame of 3/16" steel plate. All parts accessible for inspection and maintenance.

Plus other features for safe, easy operation. Your hands stay on the wheel because heel-and-toe pedal gives instant forward and reverse control without shifting. Rear wheel steering for 67 inch turning radius. Foot brake makes it possible to sweep downhill. 12 cubic foot dirt hopper empties hydraulically in 10 seconds.

WRITE TODAY *for photos and performance data. G. H. Tennant Co., 771C N. Lilac Drive, Minneapolis 22, Minnesota.*

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Industry's Most Widely Used
POWER SWEEPERS

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Hall Industrial Water Report

VOLUME 9 MARCH 1961 NUMBER 1

Ignoring a problem will not solve it

But some industrial waste water problems are being ignored until state authorities threaten to stop plant operations. Then there is often a frantic scramble to clean up waste waters in the short grace period which is usually allowed.

How much more orderly, effective, efficient and economical it is to make a thorough survey of the whole plant before the heat is on! All uncontaminated water should be segregated for reuse or disposal. All pollution of water should be minimized at the source before treatment procedures are considered. All processes should be studied to control water usage and to avoid loss of valuable materials.

Hall Laboratories is particularly well equipped to help you with waste water problems—as well as plant-wide water management, from procurement through process, cooling and boiler use to final disposal.

Wasted raw material

A rubber manufacturing plant uses a clay slurry to coat an intermediate product. During a preliminary process and waste water survey, Hall staff engineer E. G. Paulson was informed that not more than 10 percent of the clay was being lost from the process. However, the gauging and sampling program and material balance calculations showed that more clay was being discharged from the plant than could be accounted for by production figures.

The gauging and sampling program was repeated. Results checked those obtained previously. To pin down the source of suspended solids in the plant effluent, Paulson had the suspended material identified by petrographic and X-ray diffraction procedures. Sure enough, 90 percent of the clay was being discharged to a stream rather than adhering to the product.

This is a pilot plant

Pilot plants are not always as small as one might think. Size depends on what is being studied. The relatively large plant in the picture was built to study waste water problems for two nearby mills—to study treatment of concentrated waste dumps for one mill, and to define design criteria for a proposed continuously operating waste system in the other mill. Through this pilot operation, operating personnel developed a procedure for treating the waste, obtained practical operating experience and had a plant large enough to temporarily solve the waste problem at one mill.

Through the joint efforts of Paulson and the plant engineers, the process was revised to save the bulk of the clay. Estimates indicated that the saving in raw material would pay the cost of the process changes in approximately nine months.

Long-range planning pays off

Because plant management at a detinning plant wanted to arrive at thoroughly sound decisions on procedures and facilities needed to render waste waters suitable for discharge, they had Hall staff engineers work on the problem for several years.

At the time the first survey was made, sanitary and process wastes were combined. The first change involved segregation and discharge of sanitary waste to a municipal sewer. The process waste water came from seven different operations. Samples from each were analyzed. Three waters were uncontaminated practically all of the time. One was polluted occasionally. Usage of water was modified to reduce the volume of contaminated water.

When all in-plant changes had been completed, another survey was made. One flowing rinse water and two concentrated solutions, dumped batchwise, now accounted for all polluted water. Through co-operative efforts the plant's research department and Hall's laboratories developed a procedure for treatment of the waste water.

The analytical work done in connection with the survey led to the realization that a considerable quantity of tin was being lost in waste water. A little further work showed that it should be possible to recover enough metal to increase plant income by $300 per day. This major saving prompted drastic revision of process which in turn reduced polluted water volume to three relatively small batches per week. This water is easily treated by the process developed by plant and Hall Laboratories personnel.

New booklet available

A new 24-page booklet describes the many ways industry can use Hall Laboratories industrial water consulting services.

For your copy, write on your letterhead to:

HALL LABORATORIES
HAGAN CENTER, PITTSBURGH 30, PA.
Consultants on Procurement, Treatment, Use and Disposal of Industrial Water

DIVISION OF **HAGAN** CHEMICALS & CONTROLS, INC.

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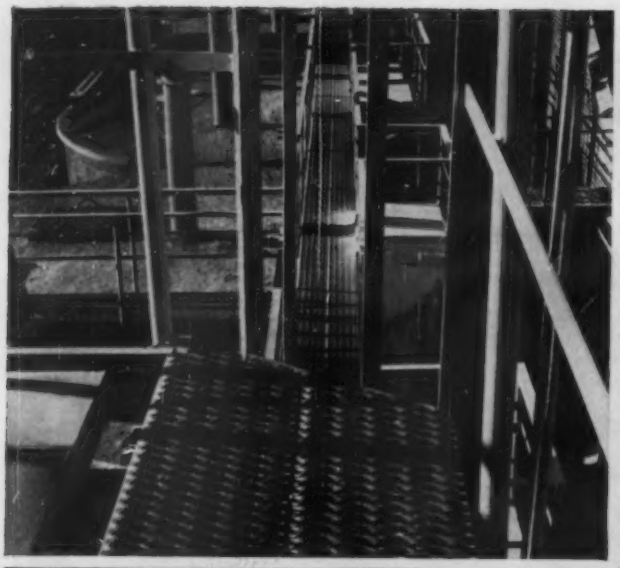
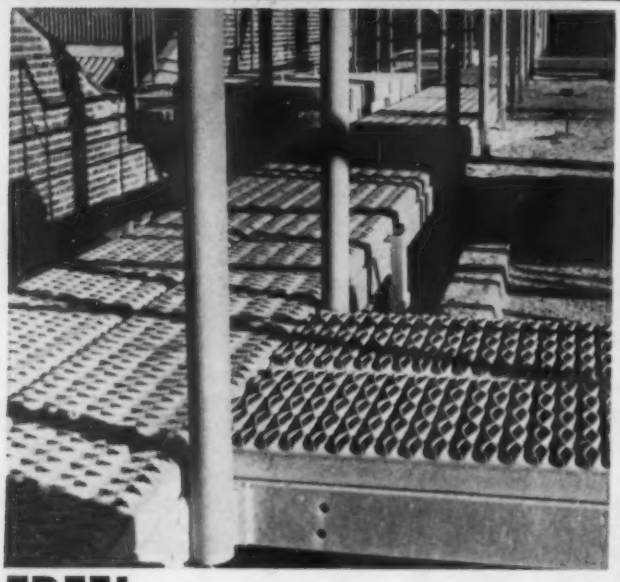
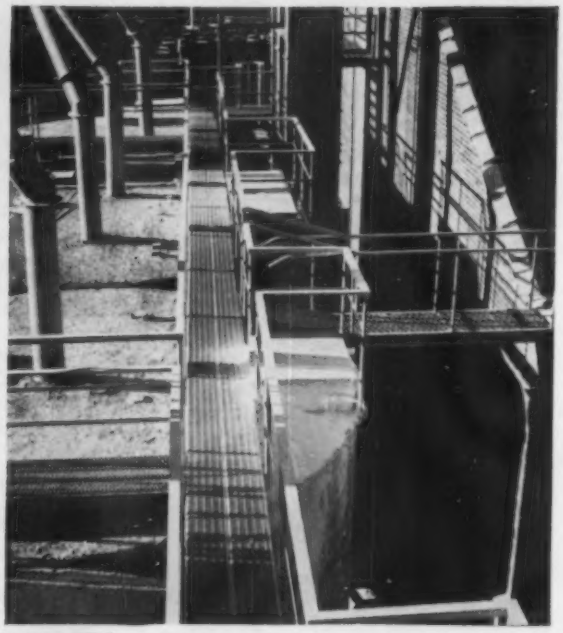


CATWALKS... *anyone?*

See how Owens-Illinois solved their catwalk problems at their **LIBBEY GLASS PLANT** at Toledo with GLOBE'S *Safety* **GRIP-STRUT** PATENTED





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GLOBE

119

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WHEN THE PROBLEM CALLS FOR PAINT THE BEST ANSWER

IS INVARIABLY **Barreled Sunlight** Paints

ENGINEERED

Take a look at the effect process fumes have on painted surfaces in your plant. Unsightly discoloration marks their presence. Next comes corrosion that can tear the hide off the toughest building material and send your maintenance budget "up in smoke".

Before this happens, however, you can take steps to end this costly deterioration. Your first move is to call in a Barreled Sunlight Engineered Paint representative. This man *knows* how paints react to various industrial fumes. He knows which paints best withstand their yellowing and corrosive action. He can also show you — with an "on-the-wall" demonstration — how Barreled Sunlight Paints save on application costs, go on faster and easier with fewer coats.

Give this man an opportunity to help solve *your* specific paint maintenance problem. The coupon below will put him in touch with you promptly and without obligation.

FREE! BARRELED SUNLIGHT PAINT "SLIDE GUIDE"

Contains complete information on Barreled Sunlight Exterior and Interior Finishes, Colors, Primers, and Thinners plus full application and special resistance data.

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I want help in selecting the right paint for a specific job in our plant.

☐ Please have your representative call me to arrange an appointment without obligation.

☐ Please send me your new "Slide Guide" to Barreled Sunlight Paints.

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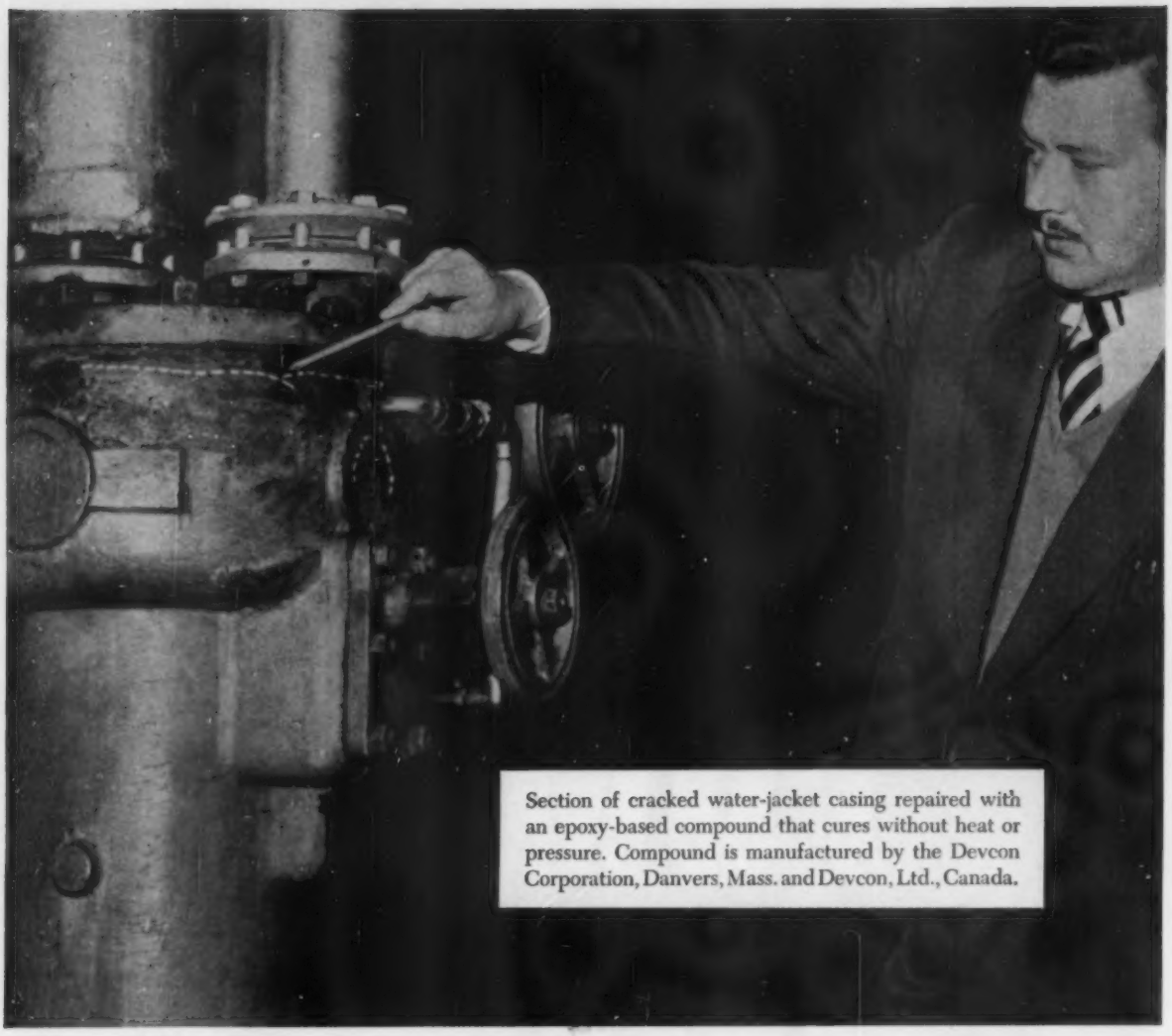

Section of cracked water-jacket casing repaired with an epoxy-based compound that cures without heat or pressure. Compound is manufactured by the Devcon Corporation, Danvers, Mass. and Devcon, Ltd., Canada.

EPOXY-BASED COMPOUND USED IN REPAIR OF COMPRESSOR

results in savings of more than $1200

When an ammonia compressor at a large brewery developed extensive fractures around the cylinder casing, it was repaired quickly with an epoxy-powdered steel compound called "Plastic Steel." The compressor *continued in operation* during the repair. It was estimated that savings in labor, materials and down time were in excess of $1200.00.

Compound based on BAKELITE liquid epoxy resins, such as the one used for this repair, can be brushed, sprayed or troweled and are ideal for a wide variety of industrial maintenance applications.

For more information on how you can solve maintenance problems with epoxies, contact your nearest supplier of BAKELITE epoxy compounds, or write Dept. HL-100C, Union Carbide Plastics Company, Division of Union Carbide Corporation, 270 Park Ave., New York 17, N. Y. *In Canada:* Union Carbide Canada Limited, Toronto 12.

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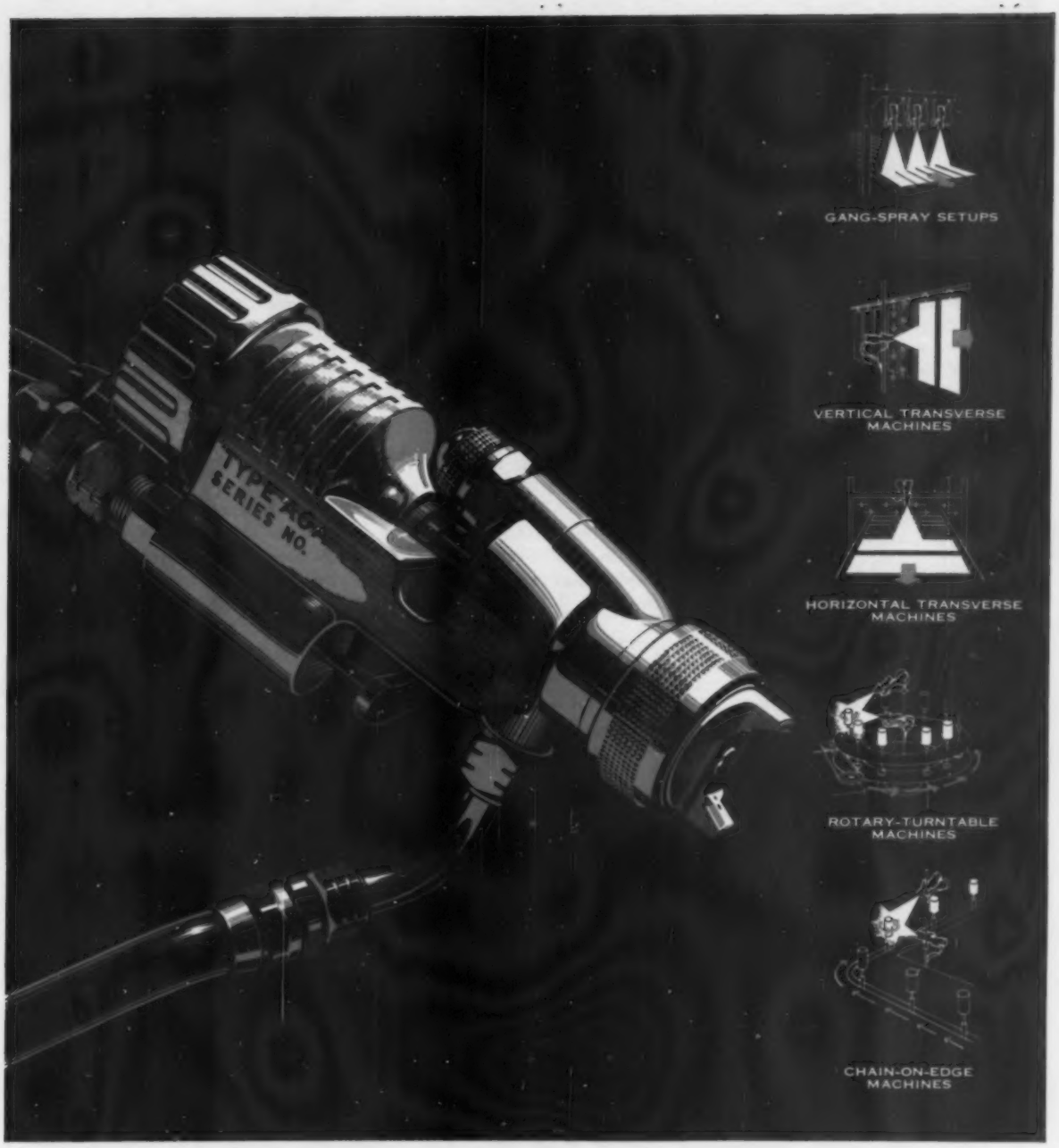

automatic spray from DeVilbiss gives you control and uniformity not possible by other methods for applying paints, adhesives, glazes; marking, stenciling. It's part of a complete line of matched equipment for coating and finishing: spray guns, dip and flow coaters, spray booths, air and fluid hose, ovens, spray washers, air-replacement units, dust collectors, "turn-key" finishing systems.

Talk to DeVilbiss about all your automatic spray-coating needs

FOR TOTAL SERVICE, CALL
DEVILBISS

THE DeVILBISS COMPANY, Toledo 1, Ohio. Also Barrie, Ontario; London, England; São Paulo, Brazil. Branch offices in principal cities.

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HOUGHTON HYDRAULIC FLUIDS

Important differences in fire-resistant fluids

Unlike petroleum oils, fire-resistant fluids have markedly different chemical properties which should be carefully considered before making a final selection.

To simplify this selection, we show here some of the variables—and limitations—of the three major fire-resistant types. Houghton is uniquely qualified for this unbiased analysis since we favor no one type over another. We make them all—and a full range of hydraulic packings as well.

1. Water-Glycol Fluids

These fluids contain water, glycol and a thickener. They provide the highest degree of fire protection. They are also compatible with the widest range of packing materials including those commonly used with petroleum oils. They should only be used, however, in systems operating at reservoir temperatures below 150°F.

Houghton's Houghto-Safe 200 and 600 Series are of this type and enjoy top acceptance and use by the armed services, as well as general industry. This wide-spread usage is due to important additives that provide *extra* anti-wear, rust inhibiting, anti-foam and metal deactivator properties to improve performance and increase pump life.

2. Phosphate-Ester Fluids

Fluids of this type are composed of straight phosphate esters and may contain small amounts of additives. These fluids can be used over the widest range of hydraulic pressures; they provide maximum lubricity for heavy bearing loads, and will stand up where ambient temperatures exceed 150°F. Packings used with these fluids must be Butyl, Butyl-Fabric or Polysulphide-impregnated Leather.

Houghton's Houghto-Safe 1000 Series are phosphate-ester fluids specially selected and compounded with additives to improve wear and rust resistance and add other proven operating benefits. Here again, Houghto-Safe 1000 Series has earned acceptance and is used on many military and space projects, as well as many of industry's toughest applications.

3. Emulsion Fluids

These fluids are either emulsions of water-in-oil (non-ionic) or oil-in-water (anionic). The following statements pertain to the water-in-oil type which are most widely used in industrial hydraulic systems.

Since these fluids are made of water and petroleum, they are compatible with standard Buna N rubber packings. They are also the lowest cost of all fire-resistant fluids. Their fire resistance is also the lowest of all three types; they should be used only in areas requiring a moderately safe fluid. The operating pressures of these fluids is generally limited to under 1000 psi.

Houghto-Safe 5000 Series designates Houghton's emulsion type fluid. It is a water-in-oil (non-ionic) fluid not affected by water hardness. Special additives are used to provide stability of the emulsion and to increase lubricity.

COMPARISON OF HYDRAULIC FLUIDS

Fluid Type	Viscosity Temperature Characteristics	Fire Resistance	Lubricity	Max. Fluid Temp. °F.	Relative Cost
Emulsion Fluids	Fair	Fair	Fair	See Note	1
Water-Glycol Fluids	Very Good	Excellent	Good	See Note	2
Phosphate-Ester Fluids	Poor	Good	Very Good	See Note	3

NOTE:—The Joint Industry Conference (JIC) Hydraulic Standards recommends the following where systems are operated continuously.

1. For water base fire-resistant fluids, the temperature of the fluid should be controlled so as not to exceed 120°F. at the pump inlet.

2. For other fluids, including petroleum oil, the temperature of the fluid should be controlled so as not to exceed 130°F. at the pump inlet.

For unusual system conditions where it is impossible to adhere to these reservoir temperature levels, the Houghton representative should be consulted.

For detailed information booklet describing all types of fire-resistant fluids, or help in selection, call your Houghton representative or write: E. F. Houghton & Co., 303 W. Lehigh Avenue, Philadelphia 33, Pa.

Houghton

INDUSTRY'S PARTNER IN PRODUCTION

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'BUFFALO' SINGLE SUCTION PUMPS

PUMPING APPLICATIONS: ● Clear water ● Saturated refrigerants ● Chemicals ● General Service

ADVANTAGEOUS FEATURES: ● Interchangeable parts ● Full ball bearing construction—takes speeds to 3500 rpm. ● Durable solid shell ● Efficient design ● Available in most machineable alloys

Few pumps are so adaptable to so many jobs. For capacities from 5 to 1200 gpm, they are the answer from clear water supply to handling an acid solution. High-speed ball bearing design often means selection of a smaller size for a given volume. Durable overall construction means low costs over the long pull, too. Write today for Bulletin 976 and see how profitably you can put these almost universal pumps to work!

"Buffalo" PUMPS

BUFFALO PUMPS DIVISION OF BUFFALO FORGE COMPANY

Buffalo, N. Y.

Canada Pumps, Ltd., Kitchener, Ont.

Buffalo air handling equipment to move, heat, cool, dehumidify and clean air and other gases.

Buffalo Machine Tools to drill, punch, shear, bend, slit, notch and cope for production or plant maintenance.

Buffalo Centrifugal Pumps to handle most liquids and slurries under a variety of conditions.

Sugar machinery to process sugar cane, coffee and rice. Special processing machinery for chemicals.

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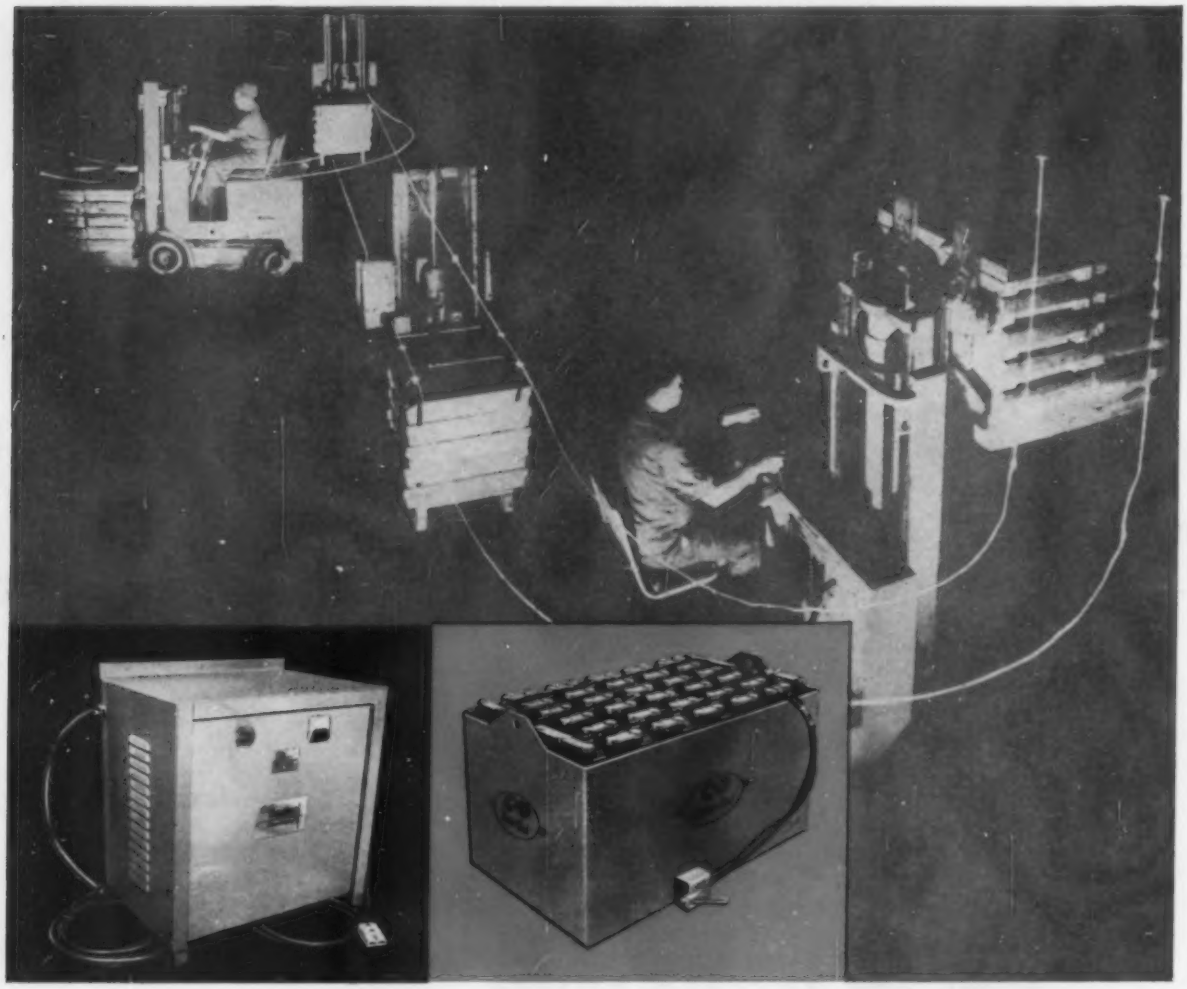
reliability

Reliable electric trucks used in your materials handling operation will prove an even greater asset if you use C & D's power team. C & D Slyver-Clad batteries plus C & D AutoReg chargers give you a truck power source unmatched for life, economy and simplicity of operation. Extra thick plates in C & D Slyver-Clad batteries provide extra life. Five Fold Slyver-Clad insulation and retention virtually eliminates life-shortening sediment build-up. Hi-Impac cell covers and containers, exclusive in C & D Slyver-Clad batteries, resist breakage and drastically reduce the need for battery repairs. C & D AutoReg chargers with Slyver-Clad batteries complete the perfect power team. AutoRegs are highly efficient, simple to operate and have no relays to adjust. Operation does not require trained personnel. A unique charging circuit, incorporating a hermetically sealed silicon rectifier, automatically supplies the required charging current and increases battery life expectancy. Because the rectifier doesn't age, aging taps and the need for adjustments are eliminated. AutoReg chargers are ideal for any type of plant layout. They may be wall, balcony or floor mounted. Smaller models can be truck mounted. All AutoRegs will improve the performance of any make battery. Regardless of the nature of your truck fleet—hand, rider, or combination of both—it will pay you to combine Slyver-Clad batteries with AutoReg chargers. Write for AutoReg and Slyver-Clad bulletins.

For ultimate reliability—electric trucks powered with C & D *Slyver-Clad*® batteries—charged by *AutoReg*®!



C & D BATTERIES
of Conshohocken, Pa.
DIV. THE ELECTRIC AUTOLITE CO.

Manufacturers of Slyver-Clad® Industrial Batteries • PlastiCell® and PlastiCal® Batteries for Communications, Control, and Auxiliary Power • Producers of AutoReg® Silicon Chargers and AutoCal® Charger-Battery Combinations

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WHAT'S JUST AHEAD IN THIS ISSUE

- ONE OF THE best-documented, most realistic articles ever published on small plant maintenance planning and scheduling starts on the next page. Dan Poppe, the author, shows how Uranium Reduction Company saves dollars and hours through the intelligent use of a maintenance planner and a scheduling board, plus careful study of each job so the mechanic can pre-select the proper tools and parts for the job. Time studies prove that the system works.

- HOW DOES a company decide which type of industrial truck is best for its particular operations? The Crane Company in Chicago did it by conducting a survey which resulted in some down-to-earth figures on truck operating costs and utilization. You'll find more information in the article beginning on page 108.

- ELECTRICAL wiring diagrams have moved over to the production line, in a sense. To simplify—and speed up—the preparation of diagrams, Western Electric has incorporated a number of ideas, such as the use of plastic templates and photographic techniques. For full details of this process, see page 119.

- AIR CONDITIONING an old plant is considerably more difficult to accomplish than air conditioning a plant under construction. How several old buildings, of different types and with varying problems, were air conditioned is the subject of the article starting on page 122.

- A THOROUGHGOING explanation of the seven reasons for lubrication troubles in industrial motors is presented in the article starting on page 126. Author R. L. Nailen tells how to avoid these problems and also explains how faulty lubrication practices can cause unnecessary expense and downtime.

- CUTTING A DOOR through a basement wall sounds simple, but GE's plant engineers at Richland, Washington, found the wall had been reinforced as a girder during construction. Ingenious—and exacting—jacking of the wall was required to do the job, as described on page 133.

- CENTRIFUGAL COMPRESSORS can be assured many years of untroubled operation if basic maintenance procedures are followed. To help you set up a satisfactory program, the author has prepared a daily, weekly, monthly, semi-annual and annual checklist to follow. He also provides a helpful table on trouble areas and their "cures." The article begins on page 139.

Small companies can cut costs, speed work, without complicated forms or involved systems

with MAINTENANCE PLANNING

By DAN G. POPPE, Plant Engineer, Uranium Reduction Company, Moab, Utah

TODAY, MAINTENANCE planning and scheduling are commonplace in the larger plants but are somewhat rare in lightly staffed maintenance department such as ours at the Uranium Reduction Company of Moab, Utah.

This plant is engaged in uranium ore milling wherein mine run ore is converted to uranium concentrate preparatory to further purification in government-owned installations. The plant employs about 210 persons, 45 being engaged in maintenance and repair.

After the startup period during which time maintenance costs were largely ignored in favor of rapid, sometimes crash methods of getting and keeping the plant on stream, management turned its attention to cost reduction. One of the most promising areas of investigation appeared to be maintenance cost reduction through planning and scheduling.

Preliminary investigation revealed that much work along these lines had been done in the larger industrial plants but very little in the smaller shops. The systems varied in complexity but in most cases it was apparent that the over-all results achieved were gratifying. It was decided that a plan could be formulated to fit a maintenance staff of about 40 and be one which would require a minimum of paper work and a small planning staff. The paper work could be kept to a minimum by using a production control board, making the scheduling of work flexible and paper-free, a Kardex system having a custom-made card for recording repair history and time efficiency, and the consolidation of reports into graphical form.

Waste Motion

Investigation of present work methods revealed some inefficient actions that could be eliminated by planning the job in advance. Repetitive trips from the site to the warehouse and shop during the job was found to be time consuming. This not only increased maintenance costs but in some cases would increase production costs if standby equipment was not available.

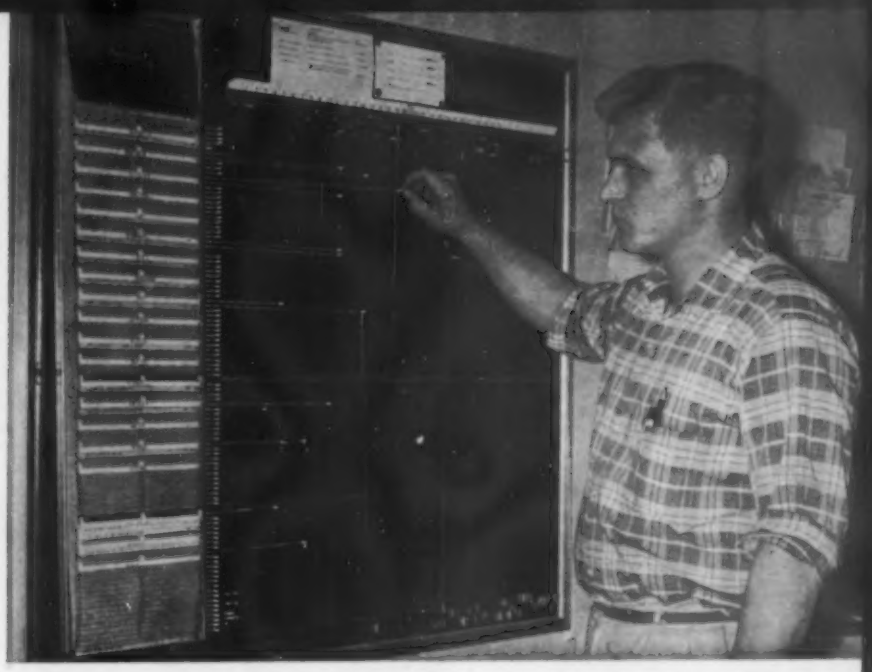
Information concerning how and when the job would be done was sometimes overlooked, thus causing the work to be repeated, revised or oftentimes discontinued. Discontinuing a job would, of course, mean moving tools and equipment to the job again when the work was resumed.

Here is a hypothetical example of what could happen on some unplanned and unscheduled jobs.

The foreman is given a work order which states that a sand pump is not pumping the proper amount of slurry. After deciding the job should be done, the work order is given to the mechanic, who is on another job, to repair the pump. The mechanic instructs his helper to put away his tools and bring other tools to the job.

On the site the mechanic finds the pump shut down and the standby in use. The mechanic then looks for the operator or operating foreman in an effort to gain more information about the pump concerning the time it failed and other particulars to help him locate the trouble. Unfortunately, the operator and foreman cannot help him on this.

After some deliberation the mechanic decides to check some particular part of the pump but discovers he needs another tool for this. The helper is sent for more tools while the mechanic contemplates the work ahead. In some cases it would be necessary for both the mechanic and helper to make the trip if the tools or equipment were heavy.



One item that keeps paperwork at a minimum at Uranium Reduction Company is this production control board with the card file system. Consolidation of reports into graphical form eliminates much paperwork.

AND SCHEDULING

Back with the tools, the work of dismantling proceeds. A worn impeller seems to be the trouble so the helper is sent to the warehouse for a new impeller. Asking for an impeller for this type pump, he returns to the job. The mechanic discovers that this impelier does not fit and decides to go back to the warehouse himself. He finds that this particular impeller is not in stock. He then searches for his foreman to find out what can be done about the job.

A properly planned and scheduled job calling for an exploratory inspection of the pump and an inquiry for proper parts by planning beforehand would have eliminated most of the problems in this time-consuming situation. The foregoing situation in total did not happen often, but many of the problems concerning materials, lack of information about jobs and repetitive trips by craftsmen to obtain materials and information were found present in most of the jobs. This was cause for concern.

In a nutshell, the repair costs ran high because it was physically impractical for the foremen to handle all phases of each job and still give each job the attention it required. Some of the necessary details involved in doing a job efficiently were: coordinating the work with production operations, material ordering, procuring the right material for the job, laying out the work, arranging transportation, scheduling of work, keeping records and giving supervision to the jobs.

After reviewing the above conditions, a plan was formulated which would reduce or eliminate the number of trips by craftsmen. What's more, it would incorporate a system where the information about a job would be presented to the foremen and craftsmen at the time the work order was issued. To accomplish these things it was decided that a Planner, a Materials Man and a Recording Man would be engaged to plan the work, provide the proper materials, and maintain records for the department.

The planning staff functions as follows:

1. **Planner**
   Plans work orders, which includes:
   a. Provides sketches of job, when required.
   b. Designates material and equipment.
   c. Outlines work procedure by steps.
   d. Estimates time (also checks estimated vs. actual).
   e. Reviews completed planned orders.
   f. Schedules work through a production control board. Schedules are made through arrangements with originator of work order.
2. **Materials Man**
   a. Receives material request from Planner, procures materials and arranges transportation of materials to job site.

(Please turn page)

Dan Poppe's interest in engineering began in the Navy while serving as engineering officer. After leaving the service he was employed by American Zinc Company, holding positions successively as foreman, draftsman and plant engineer. During this time he attended Washington University pursuing courses in industrial management and engineering. He accepted a position as plant engineer with his present company in 1956.

b. Processes all material requisitions for maintenance.
c. Assists in recording cost and time data on Kardex taken from work orders.
d. Maintains weekly planning and scheduling progress reports.

3. Recorder

a. Receives completed work orders and time cards and compares for accuracy.
b. Makes necessary entries in Kardex and equipment logs.
c. Maintains other departmental graphs and logs on information taken from work orders and Kardex.

The function of the planning section and maintenance craftsmen can perhaps best be described in a planned work order which calls for the replacement of a drum filter cloth. Figures 1 and 2 show both sides of this planned work order.

1. Originator writes description of work desired on a numbered work order giving the name and location of equipment and when completion is desired.

2. Planner receives work order, Fig. 1, and forwards a copy to the appropriate mechanical foreman who uses this as a means of advance information only.

3. Planner fills in the operation steps, designates materials and makes arrangements with the department concerned. See Fig. 2 which is the reverse side of the form shown in Fig. 1.

4. Materials Man arranges for materials to be delivered to the job site.

5. Planner schedules the job on the production control board.

6. The foreman designates which men will do the job. Job information is reviewed the day before by the foreman.

7. Mechanics proceed to job at scheduled time.

8. Work is completed and the work order is returned to planning with the actual time entered.

9. Originator of work order is notified that job has been completed.

10. Mechanical foreman makes remarks on work order, if necessary, entering actual time on the planner's copy.

11. Recorder enters data on the machinery record card, Fig. 3.

12. Original copy is filed numerically and the craftsman's copy is filed by department, resulting in a cross index file which makes future location of the work order easy.

The method of planning and scheduling maintenance work was tested for a few weeks and after some minor revisions was ready for presentation to top management. After receiving the approval of management, the procedures for the plan were presented to plant personnel in two steps for the purpose of introducing and selling the program.

1. As an introduction to the plan, all maintenance and operating supervisors were given an explanation of the economic reasons why such a program was necessary and how both they and the company could benefit by the cooperation of everyone involved in this plan.
2. The plan was then presented to all maintenance craftsmen, explanning the advantages an orderly, planned and scheduled job has to offer. One of the advantages would be going to the site with the assurance that the job would be ready for them rather than finding that the job has been cancelled or could not be done at that time. This situation can be very frustrating to the craftsman.

All maintenance supervisors and craftsmen were indoctrinated in the part they would play in this method of maintaining equipment. A meeting with all supervisors of operation was called to explain the system and review the work order procedure since the success of this program would depend upon the acceptance and cooperation of operational as well as maintenance supervisors. In fact, the degree of success in this program would depend largely upon the amount of enthusiasm by the supervisors.

Distribution of Manual

Supervisors were each given a copy of the planning manual for a better understanding of the program and the reasons why it might prove to be beneficial.

Mechanical foremen would shed some of the details that could be handled by planning personnel, allowing the foremen to concentrate on matters calling for their particular skills in supervision.

Operating supervisors would be able to find out whether or not a job or group of jobs was being worked on by calling the planning office instead of spending time looking for a foreman to get this information.

Like most new ideas the system was accepted with some reservations. Errors made in planned jobs caused the foremen and craftsmen to lose some confidence in the system. However, when this occurred, improve-

M.M. WORK ORDER No. 04193

URANIUM REDUCTION COMPANY

DATE 8-19-60

TO MAINTENANCE DEPT. JOB LOCATION 'A' Precip ACCT. NO. 6.08

[X] SHOP FOREMAN [ ] EMERGENCY REPAIR [ ] COMPLETE
[ ] CHIEF ELECTRICIAN [ ] ORDINARY REPAIR [ ] INCOMPLETE

DESCRIPTION OF WORK SPECIAL [X] GEN. [ ]

EQUIPMENT No. 1-'A' Drum Filter

Change Cloth on Filter

ASSIGNED TO B. H. Tyson Dept. Head

Fig. 1. Right: This is an example of one of the work orders. This order calls for replacement of a filter cloth.

ment or revisions made in this area restored confidence once again and the program would begin to function effectively.

Other problems developed as a result of detailed instructions issued on some minor jobs that were found to be a waste of the planner's time. There was little to be gained by planning some minor jobs that required routine repair by seasoned craftsmen. The method of doing this work was left to the discretion of the foremen and craftsmen except for scheduling and time control which accompanied the work order.

Since the results achieved in any program are the measure of success, a compilation of data since the program was installed should describe the progress made in this effort.

Before and After Results

1. We have recorded measurements of work accomplished and manpower requirements before and after planning went into effect. These are as follows:

	June 1 - Sept. 30, 1959	May 1 - August 31, 1960
Number of craftsmen based on effective man days. The number of available manpower on the job.	34.139	30.8
Number of work orders processed (electrical w. o. were not included in either period).	1,906	3,112

Additional equipment was added to the operation between September 30, 1959, and May, 1960, which increased the work load considerably. The period used in the pre-planning comparison above was made during a time when the work load was very low. For example, the number of work orders processed during the previous four months, i.e., February 1 through May 31, 1959, was 2116. The primary reason for selecting the period from June to September was to compare one of our better operating (low cost) periods before planning with an average operating period after planning went into effect.

Another reason being that all work assigned was being logged in during both periods, thereby assuring that the method of writing work orders to cover all work was the same in both cases. Preventive maintenance work orders increased starting about May 1, 1960. This resulted in more work orders being written.

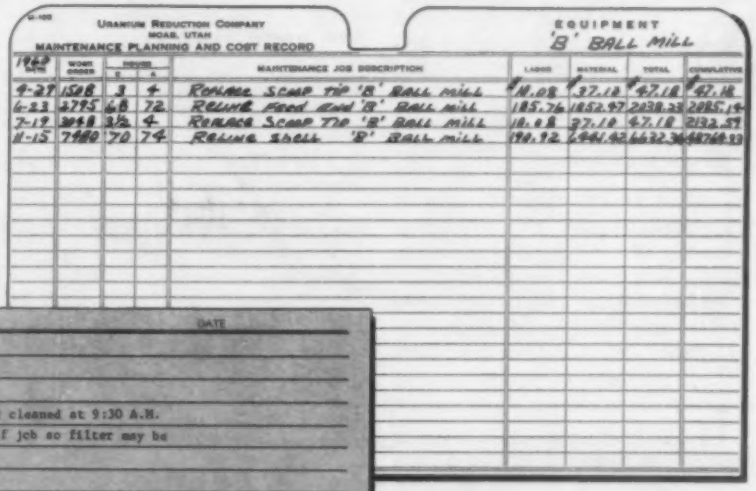
Inasmuch as it is difficult to compare one job with another unless they are the same, several identical repair jobs were compared that were completed before and after planning went into effect. The results, shown in Table I, are self-explanatory.

Labor and Cost Comparison

1. Based on an hourly rate of $2.58 per hour, the following costs and hours are presented during the periods June 1 - September 30, 1959, unplanned and May 1 - August 31, 1960, planned.

	Unplanned	Planning in Effect
a. Total work orders.	1,906	3,112
b. Labor cost per work order.	$30.72	$19.63
c. Average hours per work order.	11.59	7.61 (35 per cent time per work order)
d. Total hours expended.	22,692	23,680
e. Total labor cost.	$58,545.36	$61,094.40

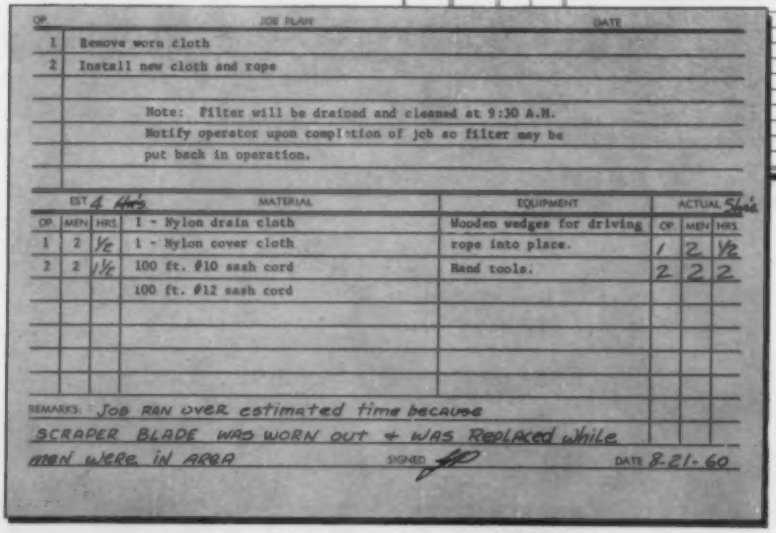
Attention may be called to the fact that the identical jobs listed required 37 per cent less time to complete after planning. Under 'c' above, the average hours per work order shows a decrease of 35 per


G-105 URANIUM REDUCTION COMPANY MOAB, UTAH

MAINTENANCE PLANNING AND COST RECORD

EQUIPMENT 'B' BALL MILL

1962 DATE	WORK ORDER	HOURS		MAINTENANCE JOB DESCRIPTION	LABOR	MATERIAL	TOTAL	CUMULATIVE
		E	A					
4-27	1528	3	4	REPLACE SCRAP TIP 'B' BALL MILL	11.08	37.10	47.18	47.18
6-23	4795	68	72	RELINE FEED end 'B' BALL MILL	185.76	1852.97	2038.73	2085.91
7-19	5448	3½	4	REPLACE SCRAP TIP 'B' BALL MILL	10.08	37.10	47.18	2132.59
11-15	7980	70	74	RELINE SHELL 'B' BALL MILL	190.92	2441.42	6632.36	8764.93


OP. JOB PLAN DATE

1 Remove worn cloth

2 Install new cloth and rope

Note: Filter will be drained and cleaned at 9:30 A.M.
Notify operator upon completion of job so filter may be put back in operation.

EST 4 Hrs

OP.	MEN	HRS.	MATERIAL	EQUIPMENT	ACTUAL 5½ Hrs. OP.	MEN	HRS.
1	2	½	1 - Nylon drain cloth	Wooden wedges for driving	1	2	½
2	2	1½	1 - Nylon cover cloth	rope into place.	2	2	2
			100 ft. #10 sash cord	Hand tools.			
			100 ft. #12 sash cord				

REMARKS: JOB RAN OVER estimated time because SCRAPER BLADE WAS WORN OUT & WAS REPLACED while men WERE IN AREA SIGNED [signature] DATE 8-21-60

Fig. 3. Above: This is an example of a machinery record card. Note that it lists all maintenance work performed on this ball mill and shows prices for both labor and material.

Fig. 2. Left: On back of work order the planner fills in the steps of operation, designates materials and makes arrangements with production area.

TABLE 1. COMPARISON OF PLANNED WORK ORDERS AND UNPLANNED WORK ORDERS

UNPLANNED 1957-58		PLANNED 1959-60	
Description	**Hrs.**	**Description**	**Hrs.**
Change chip screen	4	Change chip screen	2
		Change chip screen	2
Replace toggle in jaw crusher	15	Replace toggle in jaw crusher	10
Replace toggle in jaw crusher	15		
Tune up motor in G. E. Welder	6	Clean carb. and tune up engine #5 dump truck	4
Put new rolls in large roller crusher	60	Put new rolls in large roller crusher	33
Change cloth #1 and #2 ('A') drum filters	22	Change cloth #1 'B' drum filter	5
		Change cloth #2 'A' drum filter	4
A1 Leach 'A' Agitator dropped off	20	A5 Leach 'A' Agitator fell off	9
Replace curtains #3 sampler	9	Replace curtains #2 sampler	4
Replace belts B-5 regular pump	4	Replace belts B-1 regular pump	2
Leak in feed chute to 'A' Ball Mill	8	Leak in chute to 'B' Ball Mill	4
Replace bearing westend screw conveyor (large)	4	Replace bearing westend large screw conveyor	3
Replace rivets in shear toggle	15	Rivet crusher toggle	13
Replace troughing roll front of tail pulley #3 conveyor	4	Replace troughing roll #54 on #1 conveyor	2
Troughing roll worn near bottom #3 conveyor	6	Troughing roll #23 on #1 conveyor broken	2
		Troughing roll #50 on #1 conveyor broken	2
#A-1 SS Drag rake coming off	8	Rake coming off B-5 SS Drag Classifier	2
Replace shell liners 'A' Ball Mill	84	Reline shell section 'A' Ball Mill	74
Total	**284**	**Total**	**177**

It is apparent then from the above that 37 per cent less time was required to complete jobs after planning commenced.

The mechanics' time was accounted for by work order only before and after planning went into effect, i.e., the time accounting conditions are the same in both columns.

cent in average hours per work order after planning. Since the percentage of time saved on identical jobs is approximately the same as the percentage of time saved under 'c' above, it would indicate that the savings in time is representative of all work planned during the above period.

Note: More hours, resulting in a higher cost shown in the second column, were due to a crash equipment revision program. If 3112 work orders had cost $30.72 each, the total for the period would have been $94,635.92 instead of the $61,094.40 actual cost.

Routing of work orders and the functions of the persons involved are important to the successful operation of this planning program. The work order procedure used is as follows:

1. Qualified originator writes work order describing work sufficiently.

2. Work order is received by Planner. After approval, suggestions or changes, the work order will be planned and forwarded to the applicable foreman for execution.

3. The following information will be included or attached to the work order:

   a. Estimated hours.
   b. Recommended tools or equipment.
   c. Supplies required.
   d. Job plan (includes sequence of operation and manpower requirements).
   e. Arrangements or schedules.

4. Upon receipt of the work order, the foreman will read, check and refer any changes he may elect to make to the Planner before issuing the work order.

5. Once the work order has been initiated and issued by the foreman, the operation steps will be followed as written. Unforeseen circumstances occurring on the job, which may call for operation or material changes, will be phoned in or referred to the Planner before proceeding. If this procedure is followed, there can be no reason for the foreman or mechanic to change a planned job without notifying the Planner in advance. If the Planner is not available, the foreman will make the necessary changes.

6. The final inspection and coordination of the work order will be made by the foreman.

7. Upon completion, the work order is routed to the foreman who makes appropriate entries.

8. The Planning Section will evaluate, compare, record work orders.

Exceptions to the normal flow of work orders necessitates a different procedure from that outlined before. There are four categories of work orders in this operation and they are processed as follows:

Emergencies:

Definition: Work that requires immediate attention because of complete or partial breakdown of the process equipment which cannot be bypassed. Also, any hazard developing that cannot be avoided and en-

dangers the safety of persons, plant, or prime production equipment in the plant.

Emergencies only will be phoned in. Planner notifies foreman who makes the necessary arrangements. The Planner makes out the work order and affixes the originator's name. This order is later reviewed by operation supervisors to determine the necessity for the emergency work order. Emergency work orders are not planned unless time permits.

One Day Specials:

Definition: That work which is not classed as an emergency but must be completed during the same day it is received giving the necessary time for completion.

One Day Specials are processed in the same manner as routine work orders except that they will not be planned unless time permits. These work orders are reviewed by operation supervisors to determine the necessity for the One Day Special work order.

Specials:

Definition: That work which requires completion in less than three days. Special work orders are processed in the same manner as routine work orders and will be planned, time permitting.

General Work Orders:

Definition: That work which requires completion after three days. General work orders are planned. Control of the emergency and special work orders written is accomplished through a board of review consisting of planning personnel and high level operation supervisors. The board of review meets monthly or oftener. Questionable work orders written are brought to the originator's attention for comment.

The problems ahead in planning and scheduling still to be dealt with are work evaluation, improved time control methods on work orders and improvement in scheduling work. These problems in detail are:

Work evaluation: Some areas requiring the study of better job methods have not been investigated.

Time control: An improved method of logging in and out work orders at the time they are issued to and completed by the craftsmen is under consideration. The efficiency of estimated vs. actual time can be expected to improve under this method.

A further advantage will be an additional source of information on past jobs due to a required entry by the craftsmen on the completed job before being issued a new work order.

Scheduling: Scheduling will be made easier, faster and more accurate through the above time control method. At present there are some difficulties in starting jobs at the time scheduled resulting in some jobs not being completed on time. Up-to-the-minute information on jobs that have been started and completed will be realized when the time control method is installed. Scheduling should continue to improve as a result of further study and review of existing controls.

In summary then, plants requiring 30 to 60 maintenance employees should be able to install a system of this type if proper records are used to the best advantage and qualified planning personnel are selected. Of course, a program of this nature must have the complete backing of management before it can hope to be successful and the cooperation of all maintenance and operation supervisors is necessary in order to expect satisfactory results. The foremen and craftsmen at Uranium Reduction Company have been most cooperative in this endeavor.

A sound program will usually satisfy the maintenance foreman once he realizes the freedom from some of the detail that formerly bogged him down. Time to concentrate on the problems that are ever present on a job will be within his grasp, enabling him to utilize his particular talents.

Craftsmen will be more satisfied when they realize that an effort is being made to keep them on one job at a time until finished. Craftsmen prefer to see the job through.

Operation supervisor will be more satisfied when he can obtain information quickly about work in progress so he can time his operating functions accurately. The gains in economy and quality of work by waiting just a little longer until the job can be planned properly appear to outweigh most of the reasons for having all work done on a rush basis.

A program similar to this should prove to be of benefit to most small plants, providing the effort is maintained. Constant surveillance and revision of your system is required, especially during the first year of operation. **End**

Aerial view of our plant at Moab, Utah, will give you some idea of its size and why a maintenance planning and scheduling program was so necessary.

PART I OF A SERIES

In this and two further articles to be published in April and May, the authors tell the why, how and what of a survey they conducted to find the best type of truck for their operations. In the second article, they will discuss truck utilization and in the last of the series, the preventive maintenance system that saved $32,000 during its first eight months of operation.

Why Electric Trucks at Crane? IN-PLANT SURVEY DICTATES CHOICE

By **LOUIS MARTH**, Manager, Material Handling Operations
WILBUR T. JOHNSON, Superintendent, Material Handling Operations and
ARNOLD J. HAMILTON, Supervisor, Transportation Section and Garage all of Crane Company, Chicago, Ill.

WHEN OUR material handling engineers conducted a survey to determine maintenance costs of rolling equipment, their findings highlighted the facts that we spent well over $1 million on repairs on 272 pieces of equipment during a 10-year period.

In our materials handling operation we employ approximately 500 pieces of rolling equipment, representing an investment of close to $2,000,000 based on a replacement cost figure.

Of the 500 pieces of rolling equipment, 350 are powered as opposed to 150 non-powered. Of the 350 power units, 171 major units are under a preventive maintenance control system.

We consider major units to be gas or battery powered rider-type trucks. Included in this category are high and low lift platform, counter-balanced fork trucks, straddle-arm fork trucks, high rider straddle fork trucks, tractors and personnel or equipment carriers.

Minor units are non-rider-type trucks. In this group we have high and low lift platform, high lift counter balanced fork, high and low lift pallet, combination walk or ride tractors and miscellaneous trailing type vehicles.

Our research was conducted on three types of power:

1. Direct gas type. This included only power plants with fixed type engines that operate a vehicle through a driving mechanism. This mechanism could be a friction clutch, hydromatic drive or an electrical variation thereof.

2. Gas-generator type. This consists of a complete gasoline-driven generating unit which supplies electrical current at the proper voltage to the controller of an electric vehicle in the same manner as a battery of the proper voltage.

3. Electric battery type. An industrial battery of correct voltage and capacity to operate a vehicle for at least one full shift. This is a battery-powered vehicle.

An initial study revealed that six direct gasoline-powered fork lift trucks used by the shipping department cost us $56,177 for repairs in the previous 10 years for an average of $9363 per truck.

Electric-powered trucks of comparable capacities in the same type

A Word About The Authors

Louis Marth, who attended the College of Engineering, Wayne University, Detroit, Michigan, has had wide experience in the supervision and administration of materials handling operations. He is responsible for all functions relating to the movement of raw material and finished goods in Crane Co. plants, including the maintenance of materials handling rolling equipment.

He is Executive Vice President, American Material Handling Society (Chicago) and a member of the Technical Advisory Committee, M.H.E.D.A. National Training Center.

Wilbur Johnson, with Crane Co. since 1946, has been Superintendent of Material Handling Operations for the past five years. His responsibilities include inter- and intra-departmental transportation, the maintenance of industrial trucks and warehousing and distribution of foundry raw materials and plant supplies. He is a member of the Illinois Accountants Society and the American Material Handling Society.

Arnold Hamilton joined the Crane Co. in 1936 and was made Supervisor of the Transportation Department in 1951. He received his present position of Supervisor of the Transportation Section and Garage in 1958. Known as Crane's truck expert, he has taken materials handling and industrial management courses at Northwestern University, Evanston, Ill. Like his co-authors, he is a member of the American Material Handling Society.

Fig. 1. Electric lift truck equipped with radio and trailer hitch, loads iron gate valves into box car inside plant.

of service showed an average 10-year repair cost of $3700 per truck, or $5663 per truck less than a gasoline-powered unit.

When we consider the additional loss in downtime for repairs during which trucks were not operating (of which no record was kept), we have a very substantial sum of money to consider.

A further, comprehensive survey by our Material Handling engineers provided a basis for a continuous economic evaluation program. In the study made, the following factors were given consideration:

1. Excessive repair costs
2. Battery-powered versus gasoline-powered equipment
3. Heavy duty versus light duty operations
4. Long haul versus short haul operation
5. Necessity for control of repair costs
6. Replacement policy

We recognized that the best comparison would result from a satisfactory sampling, actual working conditions and reliable figures. The number of vehicles used gave us a good sample; the factors considered in the study were related to the subject.

Some of the findings of the study were:

- Fork trucks continuously making long hauls cost approximately twice as much for repairs as fork trucks operating in confined areas.
- Repair costs for foundry operated equipment are double those of the same type of equipment in non-foundry use.
- The average length of service for all our equipment was 13.5 years per unit, with the average recommended life being 9.2 years per unit. Average annual repair costs were $409 per unit as compared to an allowable cost of $229, based on 10 per cent of original cost.
- Average service length per unit exceeded normal life expectancy by 47 per cent and average repair costs per unit exceeded the allowable amount by 78 per cent.

From this study we concluded that to keep rolling equipment in operation beyond its normal life expectancy is poor business. The condition called for close control and a firm method for determining whether to continue or discontinue the usage of doubtful units.

Normal life expectancy for the equipment in question was recommended as follows:

Battery-powered truck
10 years—(Based on Department of Defense figures)
Gasoline-powered truck
6 years—(Based on Department of Defense figures)
Gas-generator truck
10 years—(Crane experience)
Electric storage batteries
5 years—(Crane experience)

The M.A.P.I. (Machinery and Applied Products Institute) system was recommended as a means of analysis for replacement.

Factors we considered in our comparison were as follows:

1. Initial investment
2. Life
3. Operating expense, including power source, maintenance and repair
4. Other factors such as:
   safety requirements
   type of operations

The preventive maintenance program permitted us to establish accurate maintenance cost figures to insure a proper basis for comparison and for measurement of results. We have already indicated that the sampling is adequate and that the comparison was made under similar operating conditions.

Now, let's take initial investment. It is generally acknowledged that the cost of an electric-powered truck is greater than that of a comparable gas-powered truck. For example:

Initial cost of 4000-lb fork lift truck:

Gas-powered (with muffler set-up)	$ 6,450
Electric truck, battery-powered (with 2 batteries)	12,417
Gas-generator truck	10,227

Considering only the initial cost coupled with the life expectancy, the

Fig. 2. Materials handling is big job at Crane and many different industrial trucks are employed in plant and grounds area, covering 240 acres.

TRUCK SURVEY

choice would be in the following order:

1. Gas-generator $10,227
   10-year life = $1,023 per year
2. Gas 6,450
   6-year life = $1,075 per year
3. Electric 12,417
   10-year life = $1,242 per year

Life expectancy has already been mentioned. Now for operating expense.

If one dominant factor can be said to have influenced our decision regarding the type of power to be used for the great majority of vehicles, it would be our comparison of operating expenses. Admittedly, when our research was started our company was burdened with some equipment which had become too old to afford a strictly accurate comparison. However, all types of powered equipment were approximately the same age and, incidentally, in every case the battery-powered truck was in better condition.

The cost of operating the power source for gas power, including gasoline, oil and catalytic muffler system to prevent noxious fumes, was 22 cents per operating hour.

For battery power, including cost of current used for charging, charging facilities and additional electrolyte, the cost was 1.1 cents per kilowatt hour, or 4.5 cents maximum per operating hour.

On certain types of equipment, as many as 138 months of expense data were available; on the other hand, we had to originate a method for recording additional accurate data. It was necessary therefore to project or reduce and average the figures that were available for comparison purposes.

The operating cost analysis of six direct gas-powered trucks and six battery-powered trucks has already been mentioned. Now let us look at a comparison of costs for gas-generator and battery-powered units. Table I shows figures that indicate a cost difference, in favor of battery-powered trucks, of more than $5300 per unit, based on a 10-year life. This figure helped dictate our choice of power.

Coupled with our study of repair costs, was a plant-wide equipment usage survey conducted by our Material Handling department. (Armed with service recorders, charts, graphs and enthusiasm we entered "where angels feared to tread" in each department. We came out with an amazing knowledge of the material handling needs of our plant.)

Repair Expense Formula

The first comprehensive data on maintenance costs, brought out by the Material Handling survey awakened us to the realization that there was a large saving to be effected in this area.

One result of this study was our originating an allowable expense formula to be used as a guide in flagging units with excessive repairs. This formula was basically a refinement (based on the metered engine hours) of the premise that the accumulated repair costs over the life span of a vehicle should not exceed the original cost of the equipment.

Before we finished working on this formula it was necessary to make some variations. First, because of changing prices for similar equipment, it was necessary for realistic purposes to base the allowable repair expenditure on the replacement cost of the unit. Second, actual meter recordings indicated that 82 per cent of the usage time available could be considered full utilization.

The remaining 18 per cent was accounted for by fringe benefit time (morning and afternoon coffee, wash-up time, etc.), time spent walking to and from battery charging or garage areas, waiting for elevators, receiving instructions, locating material, aisle obstructions and all other stoppage time.

Our formula was successful in accomplishing several important things for us. It served as a guide to equipment which required investigation because of excessive repair costs.

These investigations uncovered various faults in usage, floor or wall obstructions, chronic abuse of equipment and the general factors creating these excessive costs. The information received in these inquiries pointed out the need for a good preventive maintenance inspection system.

A committee was appointed to develop a preventive maintenance program which subsequently was approved by management. During our first eight months of operation, a budgetary savings in excess of $32,000 was realized.

Savings are not the only beneficial result of our preventive maintenance system. After the initial flood of repairs which were overdue because of

lack of preventive maintenance, the amount of equipment coming into the shop for repairs began to decrease.

Toward the end of the first cycle it was apparent that it would be possible to include minor repairs and adjustments in our preventive maintenance inspection and still maintain a schedule, which further decreased the amount of unscheduled repairs coming into the shop.

This action released spare equipment which had hitherto been replacing vehicles while they were in the repair shop, so that we could then dispose of old, obsolete equipment which had helped to shrink our repair dollar. We were, for the first time in many years, able to replace a vehicle needing repair with the absolute minimum of lost time.

The P.M. inspection enabled us to order wearing parts in advance and further reduce the necessary downtime of the vehicle.

One fact brought to light after six months of trial and error with the P.M. system was that we could not maintain gas-powered equipment on the same schedule as electric. It was therefore necessary to reduce the time between P.M. inspections on gas equipment to one-half of the allowable hours for battery-powered equipment. This meant 100 per cent more maintenance for gas-powered equipment and one more reason why we decided in favor of batteries.

Yet another reason for our decision was the matter of safety. Safety is everyone's concern. We are not saying that gas equipment is less safe in itself than battery-powered. What we found to be true, however, is that gas-powered equipment can be abused to the point where it is unsafe. By "abused" we mean the re-adjustment of governors by unauthorized personnel and so on, and with multi-shift operations, it is difficult to keep track of unauthorized adjustments. It is possible that before abuse to a unit is discovered, an accident will have happened. The thought immediately brought to mind is that vehicles should have adequate control. This indicates more policing and more responsibility for supervisors who probably already have enough areas of concern.

What about driver training? We have a planned training program including an obstacle course. We have shown various films to every driver. We have planned disciplinary action for violators of safety rules.

We are all fighting the battle to control vehicles and drivers. With battery-powered equipment we come nearest to doing this. We control our speed, thrust, lifts, unattended vehicles (dead man control,) etc.

Most of our operations are under roof, with proper grades and good traversing areas. We have little need for that extra torque that the gas-powered vehicle can give although we do use and will continue to use gas-powered equipment where feasible. Remember too, that these points are in favor of gas trucks:

1. More torque available
2. More speed available for long runs and grades
3. In a small operation where there is a minimum number of operators for the same vehicle and chances of abuse to the equipment are at a minimum, repair costs will be less than in an operation such as ours
4. Sustained continuous work without increasing invested capital in additional batteries

In conclusion we would like to make the following points:

- Before making any comparison, straighten out your house first, i.e., make sure present equipment is fully utilized and eliminate any practices leading to excessive abuse and maintenance.
- In making comparisons make sure all factors are included. Use your own particular cost figures, and consider your particular type of operation.
- Establish proper accounting of costs and set up a proper preventive maintenance system. **End**

Fig. 3. Trucks work both indoors and out. Plant grades are gentle which means we do not have primary need for extra torque provided by gasoline trucks.

Table 1. How we compared cost of gas-generator and battery-powered trucks.

Average costs for gas-generator units	
Operating cost (gasoline, oil, special muffler system) for power source, excluding repairs, over 10-year period:	$4400 per unit
Repair cost for gas-generator unit only, over 10-year period:	2651
Repair cost, exclusive of power source repairs, over 10-year period:	5760
	$12,811
Average costs for battery-operated units	
Operating cost for 36-v battery (charging, additional electrolyte) over 10-year period:	$900
Repair cost for 36-v battery over five-year period:	0
*Cost of new battery for second five years:	2200
Repair cost exclusive of power source repairs, over 10-year period:	4320
	$7420

*To operate a battery-powered truck for 10 years, to equal the life of the gas-generator unit, required the purchase of a second battery, which cost was added to the total.

PLASTIC TAPE HELPS REDUCE PLANT'S ELECTRICAL DOWNTIME

Plastic tape is also used for servicing wiring in the plant's transfer box.

AN INCREASE in the production of Studebaker Larks meant a challenge to the South Bend, Indiana plant of Studebaker-Packard. Production was hiked to the rate of one new Lark every 42.8 seconds. Yet a single serious electrical failure could call production to a halt, and such a failure could occur at many points along the six miles of assembly line.

"There was a time when 12 minutes downtime was allowed each day for electrical maintenance," says Cecil Fowler, plant layout engineer. "Now we've cut this down to one minute." This reduction means that, at the present production rate, some 16 extra automobiles are produced each day. This has been possible by a reduction in electrical downtime of 91.75 per cent.

How? By (1) slashing the number of electrical failures with the protection of plastic electrical tape; and (2) by developing one of the fastest-acting electrical emergency crews in the industry.

The chief trouble-makers causing electrical failures were grease and oil. Experience showed Studebaker-Packard that one cause of electrical downtime was grease and oil drippings making wires short out. Others included abrasion, moisture and acids. These were constant hazards to wiring everywhere along the six miles of assembly line. At any moment they could cause production-stopping electrical failures. Preventive measures, to be successful, had to guard against all wiring hazards.

Before making the switch to Johns-Manville Dutch Brand plastic electrical tape, the company investigated and tested its many features. They found this electrical tape gave high dielectric strength and had good resistance to grease, oil, acids and alkalies, moisture, corrosive salts and fumes—all common wiring enemies. Also, it grabbed fast, wrapped tight, stretched and conformed to irregular surfaces — provided tightly-sealed, durable insulation with ease and speed of application.

Junction boxes like these are critical maintenance spots along the Studebaker Lark assembly line. Wiring is wrapped with the plastic pressure-sensitive tape to prevent shorting due to conveyor grease and oil drippings.

The second area which reduced downtime was in the plant's electrical crew. They were always "on the ready" to correct failures immediately. A squawk box instantly blasts out in the plant when a light on a big board in the plant superintendent's office flashes on, pinpointing electrical trouble along the six miles of assembly lines.

That red light tells the superintendent exactly where the failure is. Seconds later, maintenance men in a small truck, with siren blaring, scoot to the trouble spot. For every 42.8 seconds it takes them to make repairs, a new Lark will not come off the assembly line—and the lost time can never be made up.

All of this could happen, if there were an electrical failure along the assembly lines in the South Bend plant. But this emergency action plan is rarely needed. The facts are, 58 electrical maintenance men, under Everett G. Morehouse, Manager, Plant Engineering, see to it that emergencies caused by electrical failures seldom—if ever—occur.

It is not surprising that Studebaker-Packard's top plant personnel have extensive backgrounds in electrical work. Mr. Morehouse, who has 30 years with the company, was formerly electrical boss; J. C. Learman, Superintendent of Plant Engineering, with 26 years at Studebaker-Packard, was formerly an electrician. Elon F. Meeske, Electrical Maintenance Supervisor of the Chassis Division, has been with the firm 36 years—a total of almost a century of experience combined in only these three men, not to mention the entire electrical maintenance crew. **End**

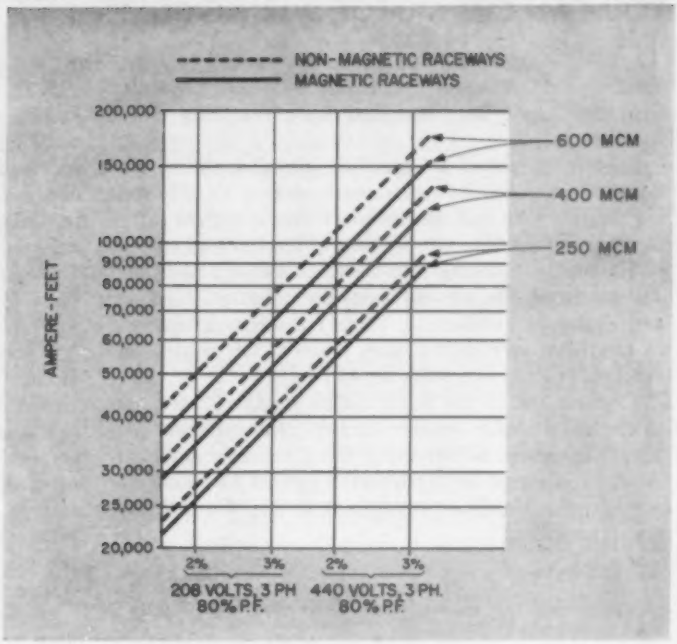


Fig. 1. Voltage drop characteristics of aluminum conductors in magnetic and non-magnetic raceways for wire sizes commonly used in feeders.

YOU CAN CUT MOTOR WIRING COSTS

By **ELDON G. FOX**, Senior Electrical Engineer, Kaiser Aluminum & Chemical Corp., Newark, Ohio

CUTTING COSTS in many areas of plant engineering work is frequently accomplished by merely taking full advantage of new materials available or re-evaluating improved techniques. A good example of this method of reducing costs is found in the application of aluminum wire and conduit to industrial motor feeders.

Unfortunately, the full economic advantage offered by aluminum conductors has not been realized in many plants due to early "rule-of-thumb" engineering. To offset the somewhat lower conductivity of aluminum, wire sizes were usually specified two sizes larger than the copper conductor required. In many cases this resulted in increased conduit sizes and generally higher costs that were, in no way related to the problem of specifying a given current carrying capacity.

Ampere for ampere, aluminum conductors cost less than copper conductors. This cost advantage is sometimes narrowed down by the increased cost of larger conduit

Table I. Comparison of conductor and conduit required for motors, one through 100 hp, operating on 440 volts.

MOTOR HP	ALUMINUM		COPPER	
	Wire* Size	Conduit Size	Wire* Size	Conduit Size
1	12	½	12	½
1½	12	½	12	½
2	12	½	12	½
3	12	½	12	½
5	12	½	12	½
7½	12	½	12	½
10	10	¾	12	½
15	10	¾	10	¾
20	8	¾	8	¾
25	8	¾	8	¾
30	6	1	6	1
40	4	1¼	6	1
50	2	1¼	4	1¼
60	1	1½	3	1¼
75	1/0	2	1	1½
100	3/0	2	2/0	2

*Based on 440 volt, 3 phase motors and RHW insulation.

YOU CAN CUT MOTOR WIRING COSTS

sizes required. However, this happens far less frequently than you might have imagined when designing motor feeders.

Feeders to motors are specified according to the National Electrical Code requirement, section 430-22, stating that the wire size selected must have a current carrying capacity equal to 125 per cent of the full load current of the motor. Working with N. E. C. tables 310-12 and 310-14 listing the current carrying capacity of copper and aluminum conductors, Table I shows a comparison of conductor and conduit sizes required for motors, one through 100 hp, operating on 440 volts.

Examination of the Table indicates that 62 per cent of the motor feeders require the same size aluminum conductor as would be needed if using copper conductors. Also, 75 per cent of the feeders required the same size conduit with aluminum conductors as they did with copper conductors.

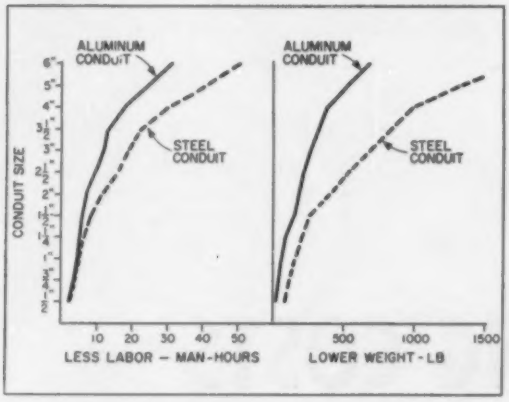
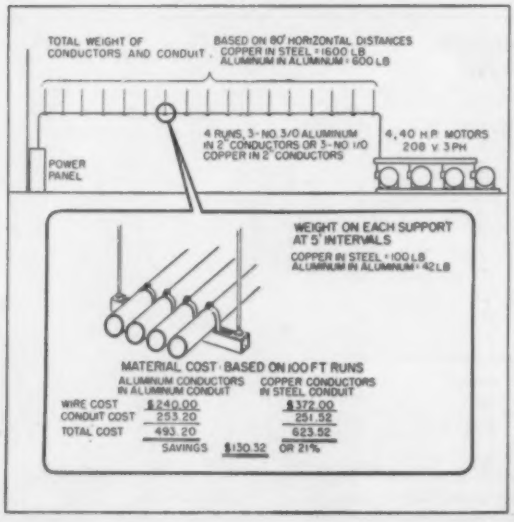


Fig. 2. Graph at right indicates reduction in weight of aluminum conduit resulting in lower labor costs.

Fig. 3. Feeder calculation shows all aluminum system saves 21 per cent over conventional materials.


TOTAL WEIGHT OF CONDUCTORS AND CONDUIT
BASED ON 80' HORIZONTAL DISTANCES
COPPER IN STEEL = 1600 LB
ALUMINUM IN ALUMINUM = 600 LB
4 RUNS, 3- NO 3/0 ALUMINUM IN 2" CONDUCTORS OR 3- NO 1/0 COPPER IN 2" CONDUCTORS
4, 40 H.P. MOTORS 208 V 3PH
POWER PANEL
WEIGHT ON EACH SUPPORT AT 5' INTERVALS
COPPER IN STEEL = 100 LB
ALUMINUM IN ALUMINUM = 42 LB
MATERIAL COST BASED ON 100 FT RUNS
ALUMINUM CONDUCTORS IN ALUMINUM CONDUIT
COPPER CONDUCTORS IN STEEL CONDUIT
WIRE COST $240.00
CONDUIT COST 253.20
TOTAL COST 493.20
$372.00
251.52
623.52
SAVINGS $130.32 OR 21%

With the exception of the 10 hp motor, you can use exactly the same size wire and conduit you have been using in the past when converting to aluminum conductors on motor feeders up to 30 hp. This table is a good illustration of the reason why aluminum circuits should be designed to meet each load requirement rather than a mere conversion of two wire sizes larger than copper. Table 310-14 in the National Electrical Code supplies all the information you will need to design motor feeders with aluminum conductors.

Voltage drop must be carefully considered when sizing motor feeders. The maximum allowable voltage drop should not exceed three per cent from the panel service to the motor terminals. However, a maximum of two per cent voltage drop is widely used and recommended for motor circuits. The voltage drop calculation should include both resistance and reactance for a-c circuits. When using aluminum conduit, the non-magnetic properties of this material causes less inductive reactance resulting in a lower voltage drop in the line.

On long feeder runs, the maximum allowable voltage drop is the determining factor in a choice of wire size. This wire size can sometimes be reduced when running wire in a low reactance raceway resulting in a reduction

MOTOR CIRCUIT DESIGN TABLE

Based on Room Temperature of 30°C(86°F)
3 Phase A-C Motors-60 Cycles
Aluminum RHW Insulated Conductors in Aluminum Conduit

	H. P.	Full Load Amps.	125% Full Load Amps.	Conductor Size	Conduit Size	Motor Starter Size	Branch Circuit Fuses	Fusible Switch Size	Recommended Ckt. Brkr. Amps.	*Maximum Circuit Length in Feet For Allowable Voltage Drop 2% Drop	3% Drop
208 Volts	1	3.7	4.6	12	½	0	15	30	15	266	399
	1½	5.3	6.6	12	½	0	15	30	15	184	276
	2	6.9	8.6	12	½	0	25	30	20	142	213
	3	9.5	11.9	12	½	1	40	60	30	104	156
	5	15.9	19.9	10	¾	1	60	60	50	98	147
	7½	23.3	29.1	8	¾	1	90	100	100	106	159
	10	28.6	35.8	8	¾	2	110	200	100	86	129
	15	42.4	53.0	4	1¼	2	175	200	150	138	207
	20	55.1	68.9	2	1¼	3	225	400	175	163	244
	25	68.	85.	2	1¼	3	300	400	225	132	198
	30	83.	104.	1/0	2	3	350	400	300	162	243
	40	110.	138.	3/0	2	4	450	600	350	180	270
	50	133.	166.	4/0	2½	4	500	600	500	184	276
	60	159.	199.	250	2½	5	600	600	500	174	261
	75	196.	245.	350	3	5	600	600	600	176	264
	100	261.	326.	600	3½	5	600	600	600	192	288
440 Volts	1	1.8	2.3	12	½	0	15	30	15	1154	1731
	1½	2.5	3.1	12	½	0	15	30	15	830	1245
	2	3.3	4.1	12	½	0	15	30	15	628	942
	3	4.5	5.6	12	½	0	15	30	15	462	693
	5	7.5	9.4	12	½	0	25	30	20	276	414
	7½	11.0	13.8	12	½	1	35	60	30	188	282
	10	14.	17.5	10	¾	1	45	60	40	234	351
	15	20.	25.0	10	¾	2	60	60	50	164	246
	20	26.	32.5	8	¾	2	80	100	70	200	300
	25	32.	40.	8	¾	2	100	100	100	162	243
	30	39.	49.	6	1	3	125	200	100	204	306
	40	52.	65.	4	1¼	3	175	200	150	238	357
	50	63.	79.	2	1¼	3	200	200	175	304	456
	60	75.	94.	1	1½	4	250	400	200	308	462
	75	93.	116.	1/0	2	4	300	400	250	309	459
	100	123.	154.	3/0	2	4	400	400	350	340	510

*Steel conduit maximum circuit length will be slightly less.

Table II. Minimum design requirements for both 208 and 440-v, three phase motors using aluminum conductors and conduit.

EXAMPLE SPECIFICATION FOR AN ALL-ALUMINUM FEEDER SYSTEM

All equipment furnished and installed must comply with these specifications, accepted practices, National and Local Code Regulations where applicable, general conditions accompanying drawings and schedules of sizes and capacities.

1. *Aluminum Building Wire—600 Volt*

Aluminum Building wires shall be U/L approved. Insulations and coverings shall meet the requirements of the U/L Standard for Rubber-covered Wire and Cable, UL-44, or for the UL Standard for Thermoplastic-insulated Wire, UL-83, latest revisions.

(a) Conductor

Aluminum conductors shall be of EC grade aluminum.

(b) Insulation

The following types of insulated aluminum conductors shall be used except where other types are specifically approved.

* RHW—Moisture and heat resistant rubber, rated 75 C—(167 F) for dry or wet locations.

THW—Moisture and heat resistant thermoplastic, rated 75 C—(167 F) for dry or wet locations.

* Braided RHW

* Neoprene-jacketed RHW for underground conduit and duct or where specified.

2. *Connectors for Aluminum Building Wire*

(a) Use exclusively aluminum-bodied connectors and terminals that are U/L listed for aluminum wire, such as T&B 60,000 Series Connectors, T&B Reddy Connectors, or Burndy Type YA-A-TN Connectors.

(b) Use a connector aid such as Burndy Penetrox A, NO-OX-ID Grade "A", or equal.

(c) Specify all switchgear, circuit breakers, etc. to be furnished with the compatible connectors (aluminum-bodied). By compatible, meaning suitable for both aluminum or copper conductors.

(d) When the aluminum lug is terminated to a copper bus with a steel or copper stud or bolt, place aluminum lug on stud or bolt followed by a flat steel washer, a Belleville washer, and steel or copper nut in that order.

(e) A Belleville washer is not required where aluminum to aluminum contact is made with an aluminum bolt or where a stud smaller than 3/8-inch diameter is used.

3. *Aluminum Rigid Conduit*

Aluminum conduit shall be Underwriters' Laboratory approved for Rigid Metallic Conduit.

Installation

For cutting, use hacksaw, bandsaw, or wheel-type cutting tools.

For threading, use standard dies and tools.

For bending, use standard tools and equipment.

EMT benders may be used on smaller sizes.

Due to its light weight, consideration may be given to the support of aluminum conduit at less frequent intervals.

Installation procedures shall follow manufacturers' recommendations.

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in conduit size. This non-magnetic effect results in cost savings in addition to those discussed for applications of aluminum conductors.

A comparison of the voltage drop characteristics of aluminum conductors in magnetic and non-magnetic raceways, Fig. 1, shows that this can be quite a factor. In addition, the lighter weight of aluminum conduit results in substantial savings on installation labor, Fig. 2.

Combining the advantages of using both aluminum conductors and conduit for motor feeders, the example shown in Fig. 3 indicates a savings of 21 per cent in material costs when compared to conventional copper conductors in steel conduits. In this typical installation of four 40-hp motors, the total supported weight of the all-aluminum system is one-half ton lighter than the copper conductors in steel conduit. The weight per support at five foot intervals is 50 per cent lighter and actual dollars saved can be best evaluated by adding the material, labor and supporting structure savings. In addition to the 21 per cent savings on material, 10 hours less labor was required on the all-aluminum system.

Application of these all-aluminum feeders to standard motor circuits can be made by applying the same sound engineering principles used with other metals. Minimum design requirements for both 208 volt and 440 volt, three phase motors is shown in Table II. The maximum circuit lengths are based on two per cent and three per cent voltage drop at 80 per cent power factor.

In order to complete an aluminum motor feeder installation that will perform safely and reliably, the connections between panel and motor must be made in the correct manner. This can be any method that insures a tight, good current conducting connection between conductor and terminal lug and between terminal lug and motor or panel bus. Manufacturers recommendations for standard installation procedures are shown in specifications. **End**

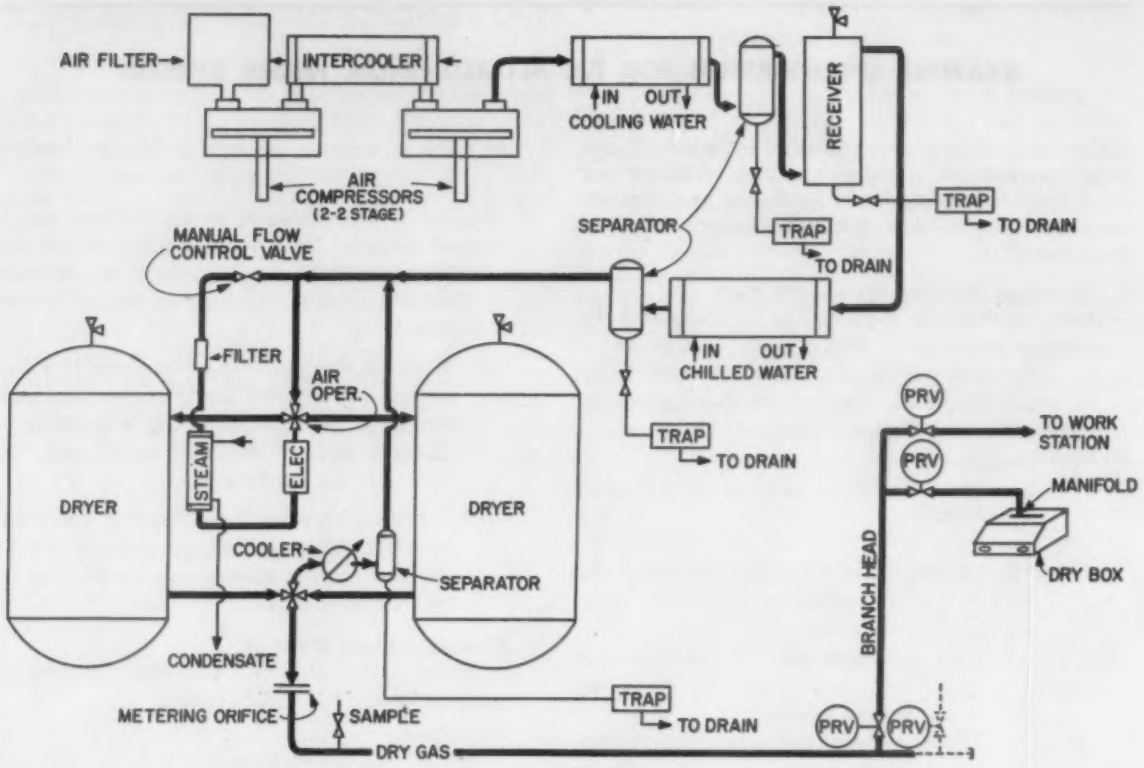


Fig. 1. Flow diagram of high pressure, dry air system. Carbon ring, nonlubricated compressors eliminate possibility of oil contamination of drying beds.

GET HIGH PRESSURE DRY AIR

for special atmospheric requirements

By **PAUL R. WATHEN**, Works Engineer
Semiconductor Department
Westinghouse Electric Corp.
Youngwood, Pa.

SUCCESSFUL LARGE-SCALE manufacture of semiconductor devices is dependent to a large extent on strict control of purity of the semiconductor metals and alloys used. The levels of impurities and sometimes the alloying agents themselves, must be maintained below one part in 10 million. Achieving these requirements implies the need for control of environment in which process and assembly operations take place.

Not only is extreme cleanliness necessary during processing, but all steps up to the final encapsulation are similarly critical. During these final steps, moisture must be eliminated to the greatest extent possible because of its deleterious effect on the electrical characteristics of the device. It is desirable to eliminate moisture in the preceding steps since water vapor may carry contaminants that cause irreversible changes in the surfaces of

the various elements of the device.

The actual atmosphere used may vary according to the type of unit and the preference of the manufacturer. Considerable evidence points to the fact that dry air is advantageous from a process viewpoint as well as cost. This article is concerned with the use of dry air though much of the discussion is applicable to other gases.

Requirements Are Stringent

Commercial drying of air is not new, though the dew points and purity required for large scale semiconductor manufacture are more stringent than those usually encountered. Dry air can be, and has been, produced from liquefaction and regasifying at temperatures below the required dew point. This process produces air at the specified moisture content and good purity, but cost is high and almost prohibitive where large volumes are required.

Commercially available liquefied nitrogen or argon may be used if an inert gas is required or if the cost can be justified because of capital expenditure necessary for a high pressure air system. Dew points obtained from systems of this nature are somewhat above the maximum liquid state temperature of the gas used.

The method used at the Westinghouse semiconductor plant at Youngwood, Pa., which is probably suitable to most large volume users, consists of air compressors, a desiccant type dryer, and a distribution system. Desiccant type dryers are manufactured by a number of companies and are available with various desiccants and methods of reactivation, although they are all based on essentially the same principles.

How to Choose Desiccant

The most popular desiccants are silica, aluminas, and zeolite crystal types. The choice made should be based on the ultimate dew point required, the operating pressure of the system, the relative humidity of the inlet air, the need for removing contaminants other than water, the temperature of the inlet air, and cost, including post-drying filters for desiccants subject to dusting.

Equipment utilizing these desiccants will consist of two vessels where continuous service is required, a method of heating the desiccant for regeneration, valving for diverting the air through either vessel and for using the air stream for removal of the absorbed moisture during regeneration and necessary temperature controls.

A type of dryer recently marketed is described as "heatless" since no heat is required for regeneration. This unit requires no services other than 110-v control power. The energy for reactivation is obtained from the pressure energy of the incoming air. Depending upon the availability and cost of compressed air compared to the cost of steam or electric power, this dryer may present advantages over other types primarily in its ability to produce low dew points.

A line diagram of the dry air system used at the plant is shown in Fig. 1. A discussion of the components of this arrangement will be helpful in understanding similar applications. The compressors used are carbon ring, nonlubricated machines, chosen to eliminate the possibility of admitting oil to the drying beds. The inlet filter on these machines is the standard type normally applied. In exceptionally dirty or contaminated atmospheres, an air washer would be required. The intercooler and aftercooler are also standard units.

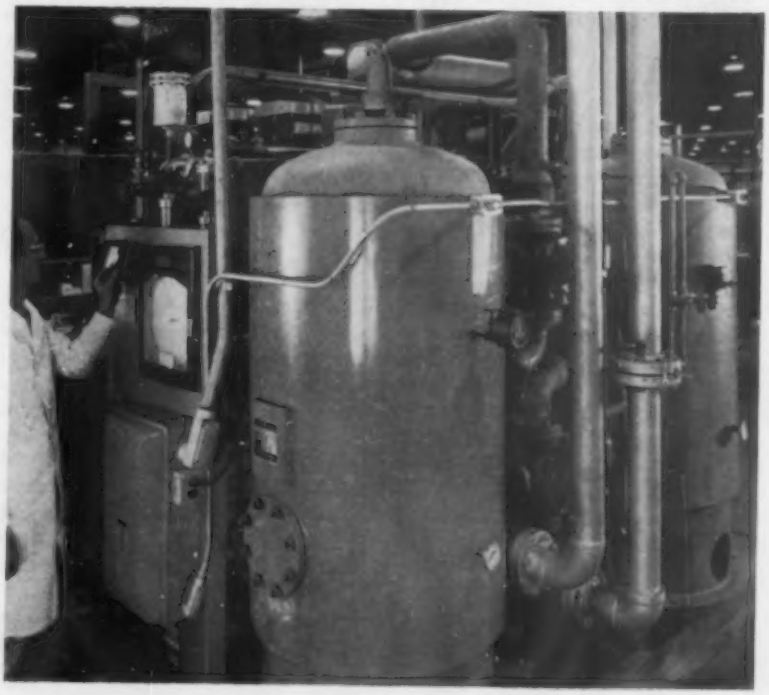
It should be noted here that the more effectively these components are utilized, the smaller the load placed on the dryer. Consequently, they should be sized somewhat more conservatively than normal practice. The second cooler is necessitated by the fact that the dryer is located in an air conditioned area which is at a lower ambient temperature than the water supplied to the aftercooler. Therefore, some condensation occurs in the pipeline from the compressor. The water to this second cooler is supplied from a chiller used for office air conditioning. The separator following then removes condensate from both the pipeline and the cooler.

Total Removal of Condensate

It is essential that this removal be 100 per cent effective, since moisture in liquid form will pass through the bed without being absorbed. It is possible to reduce the pressure or to reheat at this point to assure complete vaporization of any liquid; however, mechanical means are preferred since a pressure reduction or reheating decreases the effectiveness of the dryer.

The dryer employed is shown in

Fig. 2. Dryer using split-stream reactivation operates at high pressure.



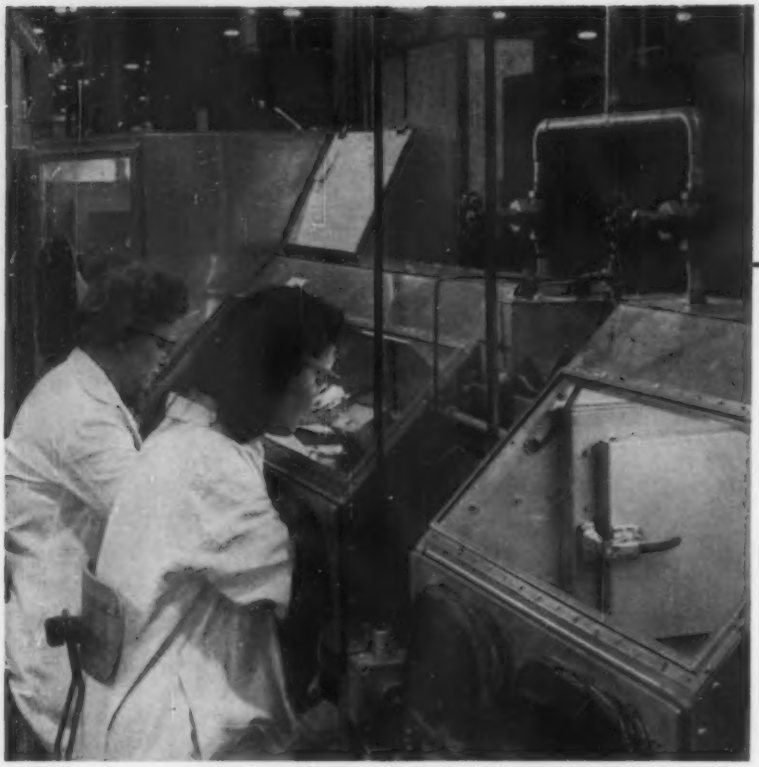


Fig. 3. "Dry box" work stations have air inlets at top. Copper manifolds are designed for diffusion of air at low velocity to prevent stratification.

HIGH PRESSURE DRY AIR

Fig. 2. This uses a split stream type of reactivation in which a portion of the inlet air is bypassed to a steam fired heater and an electrical topping heater. This air is then passed through the bed under reactivation to a condenser and separator and then rejoins the main stream to the drying bed. The reasons for choosing this dryer were based on the fact that no air is wasted for reactivation, which is carried out at high pressure, reducing dusting problems often caused by pressure changes in the bed.

The distribution system is operated at 100 psig on the mains and at reduced pressure in branch headers. A second reducing valve at the point of use decreases the pressure to a few inches of water. The use of two stages of reduction provides a safety factor in that failure of either valve will not admit high pressure to the "dry boxes" enclosing the work station. It also eliminates noisy operation encountered with small valves operating at high pressure ratios and relatively high flows.

The galvanized pipe used throughout the system was chosen because of its inherent cleanliness and the ease with which it could be cleaned during installation. The manifolds which distribute the air in the dry boxes, Fig. 3, are designed to provide an even diffusion of air at low velocity in order to prevent stratification. These manifolds of copper tubing may have holes of varying size drilled in them to compensate for pressure drop if they are more than 30 in. long.

Dew Point —90 F

The system described will produce air at a dew point of approximately —90 F. It may at times exceed this figure, but methods of measurement commonly used are not reliable below this point. Controls used at the work stations are of the electronic type which employ the measurement of the disassociation current between two platinum electrodes separated by a film of phosphoric acid as the operating principle. This cell absorbs moisture from the sample stream and the disassociation current is a measure of the concentration of water.

Instruments of this type are accurate to 5 ppm ± 5 per cent, and generally simple and reasonably rugged. They are used since they may function as a transmitter for a recorder with an alarm device should the dew point rise above process specification. These units contain a built-in calibration circuit and cell-checking circuit.

Verification of the instruments is performed with an Alnor Dew Pointer which relies on the cooling of the sample during rapid expansion to establish the dew point. It has a lower limit of accuracy of approximately —80 F. The time-honored bright-surfaced cup in an enclosure is used for determination of dew points below —100 F. Acetone and liquid nitrogen are used to produce the low temperature required.

Maintenance of this system is not considered excessive. Frequent checks of the condensate traps are made to assure effective operation. Cleaning is generally all that is required. Improvements in carbon rings for nonlubricated compressors in recent years are presently permitting operation of the air compressors for 7000 hours or more without maintenance other than minor cleaning and inspection of the valves. The dryer itself is completely automatic with only occasional inspection of the steam traps and electrical controls necessary.

The most critical item in the entire system is the lower four-way valve which handles the dry air through two ports and the hot moist air from the reactivation through the other two. Leakage from one side to the other can drastically reduce the effluent dew point. This valve should be inspected regularly to see that it is properly lubricated and that it is seated correctly. Our plans are to replace this valve with a nonlubricated type to reduce the possibility of contamination and achieve more reliable operation. **End**

Does repetitive drafting cost you money, time and nerves? If so, try Western Electric's

TRANSPARENT PHOTO-TEMPLATE TECHNIQUE

By **CHARLES A. BAUER**, Engineering Associate, Western Electric Co., Inc., Baltimore

BECAUSE OF our continuous search for more efficient and productive methods of manufacturing and the introduction of new telephone products, the Western Electric Company, manufacturing and supply unit of the Bell Telephone System, has been confronted with an ever-increasing activity in the design and procurement of machinery and facilities for the manufacture of communication equipment.

To augment our efforts of maintaining an output work schedule consistent with production schedules and consumer demands, the electrical machine design organization has had to devise time-saving devices to assist us in our fight against time. One such device has been effectively applied in our electrical drafting department.

In the preparation of electrical wiring diagrams at the Western Electric Company's Baltimore Works, new uses of transparent plastic templates and photographic techniques have substantially reduced the drafting effort associated with Western-designed machinery.

Symbols for electrical relays, contactors, motor starters, and other electrical components are inked onto transparent plastic templates. These templates, when arranged on a transparent grid-lined planning board, can

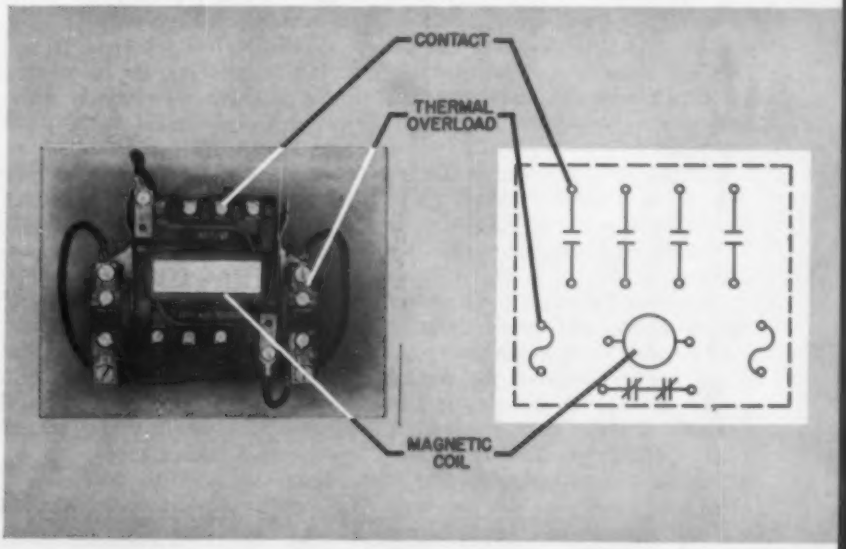


Fig. 1. Symbolic representation (far right) of a Size 1 motor starter is compared to a photo of actual product.

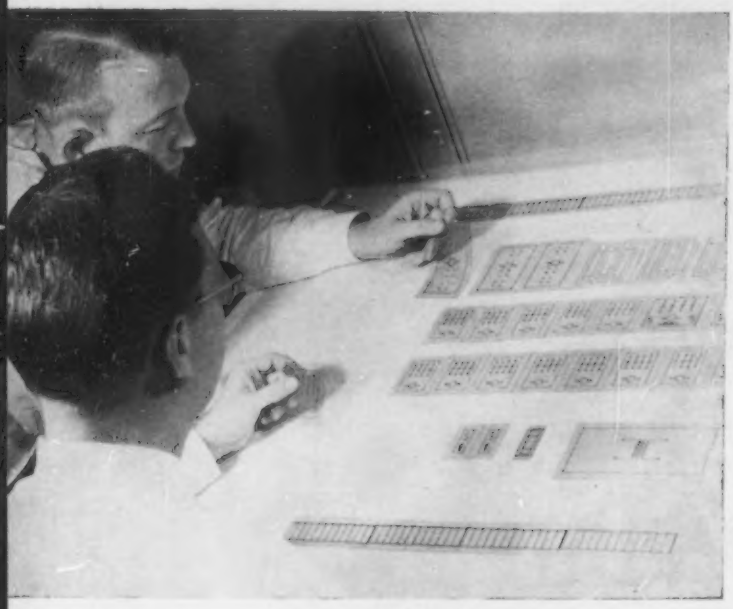


Fig. 2. After the proper templates have been selected by the draftsman he can then plan the physical layout.

TRANSPARENT TEMPLATE TECHNIQUE

be photographed so as to produce an original cloth tracing. Since the symbolic representation of practically all electrical components used in panel design work has been standardized, the templates are readily employed in the preparation and standardization of wiring diagrams.

Also, wireless wiring diagrams, which are a streamlined drafting practice in use for the past several years, facilitate the use of the transparent plastic templates and the associated photographic processes.

This photo-template technique has a twofold objective. First, the drafting time required in the preparation of wiring diagrams is substantially reduced. Second, the technique assists the engineer and draftsman in planning the physical arrangement of the electrical components for the control panel.

Drafting work involved in the design of an electrical control panel containing repetitious components is a tedious and fatiguing job. By eliminating this type of repetitive drafting, the draftsman is relieved of his weariness and productivity is stimulated. The photo-template technique has accomplished the desired results so that 1. drafting time is reduced on a particular job, and 2. more drafting jobs can be accomplished in a given period of time.

Easier planning of the drawing's physical arrangement helps answer the many questions that are raised in connection with the design of control panels. Invariably, the following questions are always asked: What size cabinet is required to accommodate all the electrical control equipment? What is the best possible arrangement of the various components?

By utilizing a template system these questions are readily visualized and answered. Templates are arranged on the grid-lined planning board to simulate the actual front elevation being proposed for a particular panel. The final panel layout is then used to determine the size of the control panel enclosure.

In order to find a more useful and flexible template system for making wiring diagrams, an extensive investigation was conducted at the Baltimore Works. This investigation resulted in the development of the transparent plastic template and photographic techniques now in use.

One system used at the Baltimore Works for many years consisted of planning an electrical panel layout with blank templates made of thin bristol board. This method was satisfactory insofar as planning was concerned but, the draftsman was still required to draw all of the components onto a linen tracing.

Templates made of double-cured, top quality plastic, with electrical symbols punched out, were considered. Again, this system was satisfactory from a planning point of view. However, to have a template kit of this nature made to our specifications would cost several thousand dollars. Even if this system were utilized, the draftsman would still perform the drawing operation that he had done in the past with the exception that he would use the punched out templates as guide lines for doing the drafting.

Next, the photographic reproduction technique was considered as an alternate solution to the problem. The idea in this procedure was originally based on templates used for floor layouts of machinery. In applying this idea to wiring diagrams, the templates would have to be reusable and a suitable adhesive had to be found for anchoring the templates in place.

Before the adhesive problem was fully explored, a manufacturer of plastic templates suitable for photographing was located.

This manufacturer has on the market template kits for office layout planning. The kit consists of a grid-lined plastic planning board and various furniture templates. For adhesion, the principle of static friction is utilized. The idea and principle needed was suggested by this kit, and inquiries were made.

Investigation finally resulted in the purchase of bulk materials consisting

of transparent green plastic sheets, special black ink, and transparent grid-lined plastic planning board. The electrical template kit was then made from the bulk material by the draftsman working with precision skill. An example is shown in Fig. 1 where the symbolic representation of a Size 1 motor starter is compared with the actual product.

The basic template kit made and used at our Baltimore Works consists of circuit breakers, terminal blocks, contactors, motor starters, reversing starters, fuses, timing relays, overload relays, and transformers. As new electrical components are utilized in our design work, templates are made of these components and added to the kit.

Grid-lined plastic planning boards were also modified to correspond with our standard drawing sheet sizes. They were finished with border lines and an accompanying title block.

Procedure in making a wireless wiring diagram of a control panel, using this system, is as follows:

Working from a print of the finished wiring schematic, the draftsman selects the templates which symbolically represent the electrical components which are to be mounted in the panel enclosure.

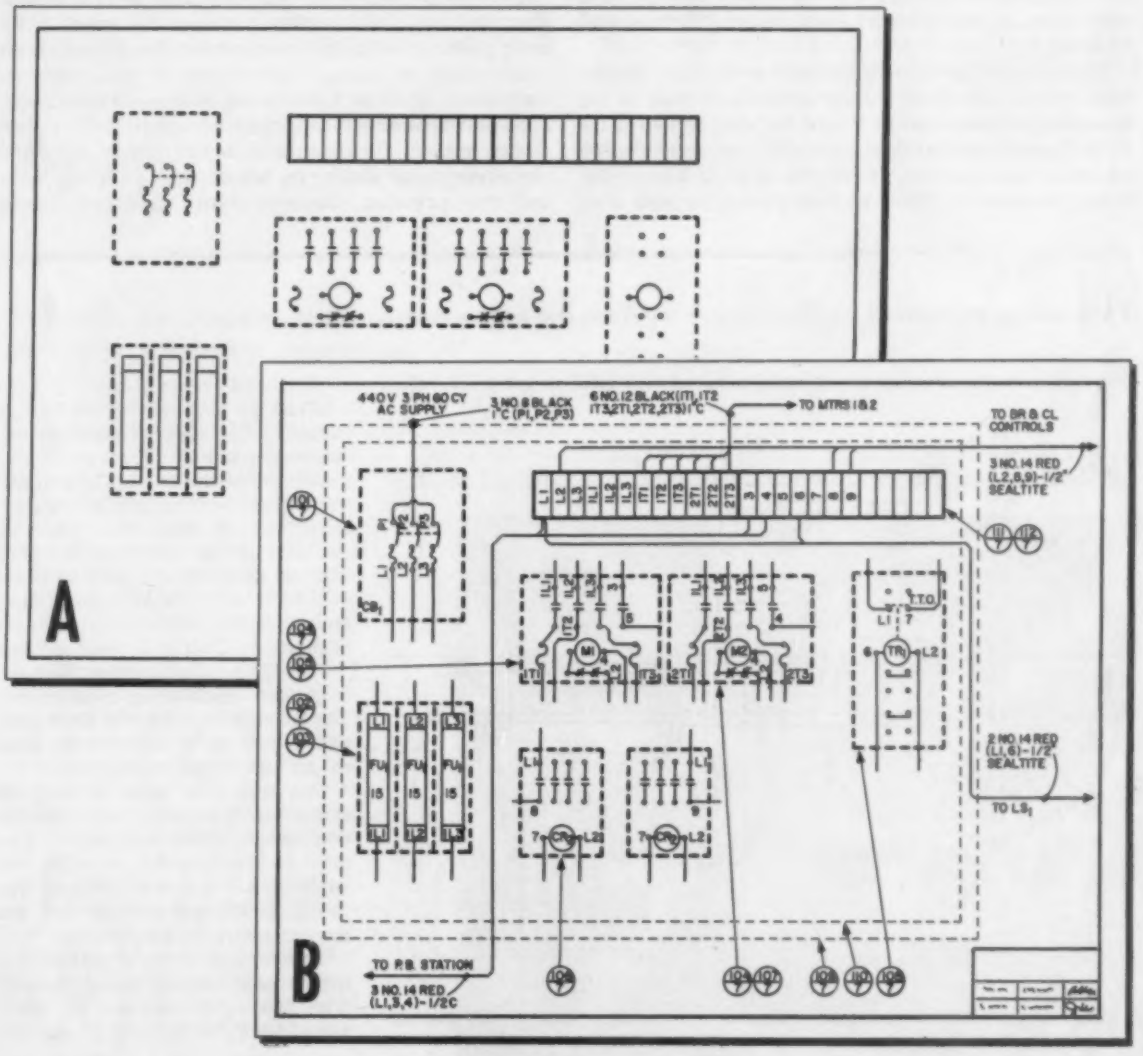
With these templates and an appropriate size of grid-lined planning board, Fig. 2, the physical layout of panel can be made.

When the draftsman has finished the preliminary layout, he then submits it to the responsible engineer for his approval. After obtaining the necessary approval, the draftsman is now ready to have the approved layout, Fig. 3A, photographically reproduced on a linen cloth by means of a contact printer copying process.

This cloth reproduction is then returned to the draftsman where the final phase of the operation, Fig. 3B, is completed. This consists of the addition of the drawing of wires, terminal numbers, detail identification of the components and necessary notes.

Through the use of this template system, the time-consuming, manual drafting has been greatly reduced for this phase of electrical design. **End**

Fig. 3. After the layout produced as shown in Fig. 2 has been approved, the reproduction of the layout can be photographically reproduced on linen cloth by contact printing as shown in A, below. This cloth reproduction is then returned to the draftsman where drawing can be completed by addition of wires, terminal numbers, etc.


A
B
440 V 3 PH 60 CY AC SUPPLY
3 NO 8 BLACK 1 C (P1, P2, P3)
6 NO. 12 BLACK (1T, 1T2 1T3,2T1,2T2,2T3) 1 C
TO MTRS 1 & 2
TO BR & CL CONTROLS
3 NO. 14 RED (L2,8,9)-1/2" SEALTITE
2 NO. 14 RED (L1,6)-1/2" SEALTITE
TO LS1
TO P.B. STATION
3 NO. 14 RED (L1,3,4)-1/2C

AIR CONDITIONING AN OLD PLANT?
Fit the System to the Situation

By **JOSEPH A. ROSENTHAL**, President
Engineers, Incorporated
Newark, N.J.

WHEN AIR CONDITIONING is used in the production areas of an industrial plant, or in any other area where people are working, the three economic advantages generally result:

1. Increased productivity.

"Comfort" air conditioning as now commonly used is an unfortunate misnomer. The word comfort implies lassitude, leisureliness, and nonproductiveness. On the contrary, comfort conditioning enables employees to perform more work, at a much higher level of mental alertness and efficiency.

Many studies have shown increased productivity results when plants and offices are air conditioned. One of the most complete was done by Public Building Service of the U. S. General Services Administration—an agency which maintains and operates 74,000,000 sq ft of floor space. When the question "Does air conditioning increase work production?" was put to them, the Building Service personnel gave a definite "Yes". Further, their study demonstrated work output by employees in an air conditioned space is more than nine per cent greater, on the average, than by employees in similar space not air conditioned.

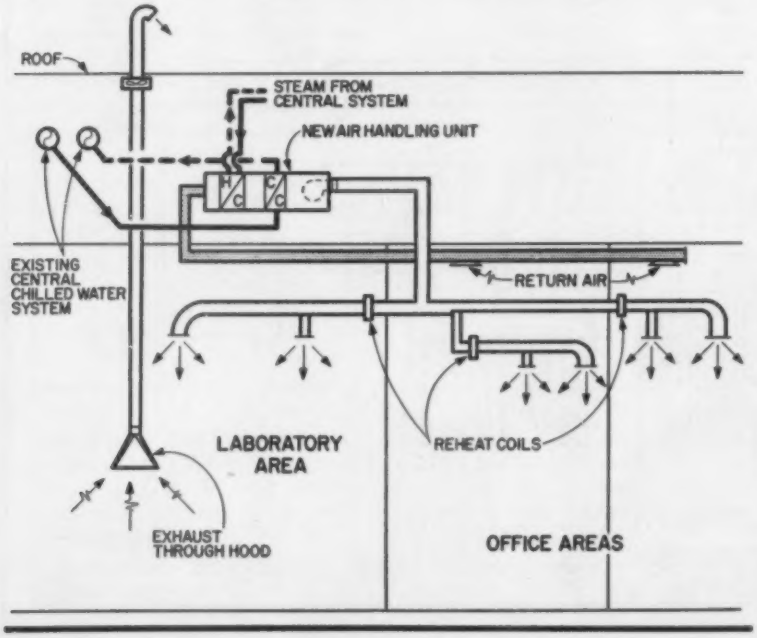
In addition, absenteeism decreased 2.5 per cent, and employees lessened work errors at the rate of .9 per cent.

2. Increased product quality, lower reject rate.

Conditioning has long been desirable in plants handling textiles, pharmaceuticals and certain paper products; printing and graphics industries also depend on air conditioning to produce highest quality. And other industries recognize air conditioning as a sound investment, because wherever air conditions are controlled, product quality goes up. Recent studies, incidentally, in metal and electronic parts industries, which are becoming more and more precision conscious, clearly show that control

Extending a central chilled-water system to laboratory, office area

Fig. 1. Schematic drawing shows multi-zone unit installed to serve lab, office.



ONE OF THE easier projects, this one involved the extension of an existing central chilled water distribution system at Merck & Co., Rahway, N.J.

Capacity of the existing system was no problem; however, low ceilings and limited over-all space made actual installation of the single air handling unit and its air ducts a problem in the 3100-sq ft area. In this newly modernized section, 900 sq ft is used for laboratories, 2200 sq ft is office space.

These two areas, however, have different air conditioning requirements. The lab requires relatively large quantities of makeup air, while in the offices the air supply can be recirculated.

One multi-zone unit, utilizing the chilled water from the main distribution system, serves both areas. A return duct recirculates the office air, while exhaust fans draw off used laboratory air. Reheat coils in each area provide control of temperatures.

This method of air conditioning makes use of existing cooling capacity; The 3100-sq ft area was air conditioned for $5700.00, or $1.84 per sq ft.

of humidity is the trend in those industries, too. Such control limits corrosion of ferrous parts, and, more important, it improves reliability of some electrical and electronic components.

3. Fewer machine adjustments due to differential expansion or contraction of precision parts and products.

The influence of air conditioning on machine tools is difficult to evaluate economically. However, relatively constant temperatures and humidities are becoming more and more necessary for two reasons: first, because machines are larger and operate at higher speeds to achieve greater precision, and second, the need for paring downtime is important.

These economic advantages are usually easy to achieve when building a new industrial plant. But how do you air condition a building that is 10 or 20 years old, to enjoy the economic assets air conditioning can bring about? First step—plan the system.

Large-scale air conditioning systems, whether they are installed during construction or after the building is in use, require five principal components to operate.

1. An energy source—usually steam or electric power.
2. A refrigeration plant.
3. A distribution system for the coolant.
4. A second distribution system to handle cooler air; this includes air dispersion units, coils, filters, ducts, and registers (or diffusers). These cool, dehumidify, clean and distribute the conditioned air.
5. A control system to maintain uniform temperature and humidity conditions when internal and external loads vary.

Of course, the decision as to which type system you should use will be based on personal as well as economic needs. You will have to choose between a centralized or decentralized system, but in either case you will need some form of the five basic components.

A central refrigeration system will consist of a single air processing plant with a network of ducts spreading throughout a plant, to carry processed air to receiving areas. And here you have a choice of six central-type systems:

A. Steam absorption. This system is frequently used in plants where steam capacity is available and low pressure steam at 15 psi or less is exhausted from steam turbines or other equipment.

B. Steam-driven turbine compressors. Usually, they are employed in plants having large volumes of high-pressure steam and an excess steam generating capacity. Thus the energy can be purchased for the cost of fuel. Energy cost is the deciding factor between types A and B, since equipment and labor charges are about the same for both steam types.

C. Electrically-driven compressors. By far the most common type in use, especially where no steam or other energy source is available, electrically-driven compressors generally produce low initial and operating costs.

D. Steam jet vacuum systems. These are the simplest and frequently the least expensive to install, but very large quanities of water must be available.

E. Systems without refrigeration. Such systems exist only where an assured supply of well water is available. If the temperature of deep well water is below 52 F, air conditioning can function without refrigeration, using well water piped directly to coils in the air distributing unit.

F. Heat pump system. A relatively new method of pro-

Partially air conditioning an old plant for precision assembly operations

When Federal Pacific Electric Co. bought the Roller Smith Mfg. Co., they decided to move the meter manufacturing operations into an old reinforced concrete building near the headquarters plant. The area to be air conditioned was on the second floor, and contained a heated assembly area and heated and ventilated office space. Total area involved in the project was 26,500 sq ft.

Detailed engineering study showed that two 60-hp direct expansion Freon compressors would be the most practical air conditioning method. These compressors were placed on the roof of the building, directly above the assembly area, then a built-up air handling unit and duct distribution system was provided. The existing office ventilating unit was modified with a Freon coil unit, to supply the cooling medium in the system.

All ductwork and fan casings were lined with sound-insulating material, because of the proximity of the equipment to the work space, and because higher air velocities were required in the limited head room.

Cost of air conditioning this 26,500 sq ft was $66,000.00, or $2.50 per sq ft.

Fig. 2. In assembly area, ducts were lined to cut down noise transmission.

AIR CONDITIONING AN OLD PLANT

viding refrigeration, it involves comparatively high installation costs. These naturally reduce the economic incentive to use this air conditioning device.

You may want to turn to decentralized packaged units, which suit smaller plant air conditioning needs. Or, should you wish to add more conditioning to a large plant's centralized system, package units are an easy answer. They offer convenience, economy and efficiency. In many cases the decentralized system will be the lowest priced one that could be installed. However—several inherent disadvantages exist in package systems.

For one thing, they have higher noise levels than central systems because compressors and distributors are adjacent to the places being cooled.

Second, package systems, generally, do not last as long as central systems—normally 10 to 15 years less.

Next, package units require floor space in work areas.

Furthermore, maintenance may pose special problems with fans and compressors located in scattered places throughout a plant, rather than housed together.

Presented here are several solutions to building owners' air conditioning headaches. Each case was studied separately by our firm, and conclusions were drawn individually. Each resulted in a different solution.

Air conditioning three unconnected buildings

UTILIZATION of exhaust steam from a central power plant simplified the air conditioning of a three-building complex at the county seat in Newark, N.J. A major, heavily-traveled street separated two buildings from the third.

The central power plant has enough capacity to generate both a-c and d-c power for the buildings, and since the generators have non-condensing steam engines, a significant amount of exhaust steam is produced. In consideration of this steam production, economic studies showed that a steam absorption system was the most economical approach to air conditioning.

The chilled water distribution system to scattered air handling centers extends through the basements or existing shafts. Due to widely fluctuating loads in selected buildings at different hours of the day, all areas have individual temperature controls.

For the air distribution, we recommended a triple duct system, concealed above the hung ceiling in the main corridors, where it fits conveniently without affecting the decor. One duct carries cold air, another warm air and the third returns used air to air handling units.

In general, supply registers are located in the corridor walls of each office. A mixing box, controlled by a thermostat within each room provides supply air at the right temperature. Return registers are located in the lower sections of the corridor partitions, and a vertical duct carries the return air to the main duct above the corridor ceiling. This design insures privacy by eliminating noise carryover from one office to the next through the return duct system. It also insures a proper flow of heated and cooled air into the various areas of the buildings, and minimizes the noise level of the system.

Total cost of this project was $1.7 million, for cooling 300,000 sq ft, or $5.65 per sq ft.

Air conditioning a multi-occupancy building

WHEN TENANTS in their 600,000-sq ft multi-story building complex inquired about installing air conditioning in their individual sections, East Newark Realty Co., owners, initiated a study of the problem. This study, conducted by our firm, revealed that the existing steam generating plant had both the capacity and the manpower to operate during the summer season, as an energy source.

This fact, coupled with the results of a cost study to determine the cost of chilling water, led the firm to install a 100-ton steam absorption machine and a piping system to distribute chilled water through the several buildings.

Each tenant rents from 2000 to 5000 sq ft in the buildings, which were formerly used in a large textile operation. As part of the complex, the Realty company operates a steam plant, sells process steam, heating steam and electricity to each tenant.

As the need for added capacity occurs, absorption units will be added to the refrigeration system. Cooling water for these units comes from the same source as that used for the existing turbo-generator condensers.

The system will offer chilled water to tenants desiring to install air conditioning as the absorption units become operative. This will permit occupants to install their own air handling and distribution systems without purchasing the necessary refrigeration capacity, and without being concerned about adequate electric power or water capacity. Charges will be prorated according to tenant consumption of chilled water. **End**

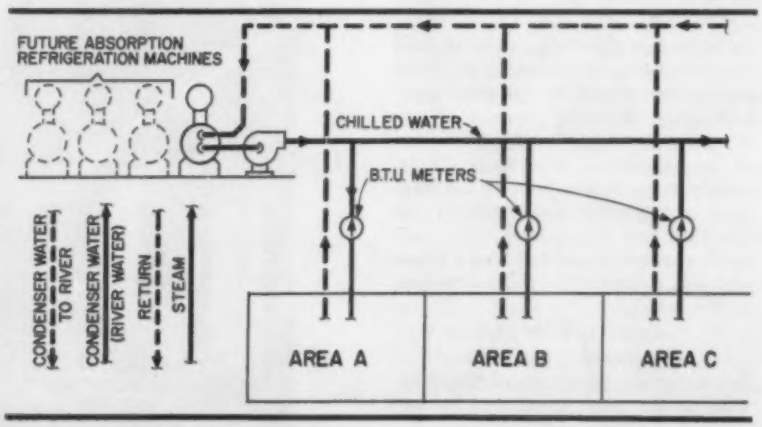


Fig. 3. Centrally-located unit supplies chilled water to several building areas.

HOW ACCIDENT COMMITTEE MAKES WORKING SAFE

Safety posters strategically placed throughout Universal Form Clamp's plant serve as reminders to keep workers conscious of safe habits.

SAFETY FIRST — Not First Aid" is more than a slogan at Universal Form Clamp Co. located on Chicago's near northwest side. A beehive of activity, especially in the summer months when its 300 employees are keeping contractors all over the country supplied with concrete forming products, is enough to make the most safety conscious worker a menace to himself as well as his fellow workers.

Call it good fortune if you will but the many precautions taken and the consistent daily efforts to maintain an established safety program that works, should not be overlooked as playing an important part in reducing Universal's accident frequency rate for the past three years from a figure that was over the national average to a figure presently 60 per cent under the national average.

To begin with, a safety committee was formed. Every foreman, together with plant management, made up the safety committee (approximately 16 men in all.) Meeting once a month, the committee outlines and discusses every unsafe situation that exists, from inattention while walking in the plant, to poor stacking procedure of material.

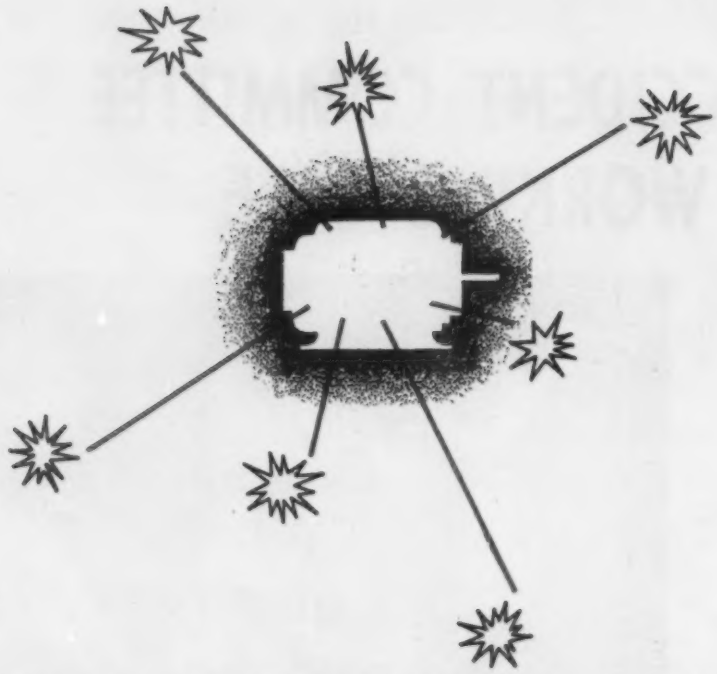
Once an unsafe situation exists, a remedy is suggested and a report on the action taken is made at the next meeting. Films also are shown at some of the meetings covering such subjects at lifting, alertness at the machine, and how not to operate various plant transportation vehicles.

Employees who are found to be working unsafely or creating an unsafe act are so advised by a member of the safety committee. Usually such unsafe acts are not intentional and are corrected immediately. When an accident does occur—either serious or minor—a comprehensive investigation is made; how it happened and why. Part of the investigation requires that all of these questions be answered:

1. Was injured man properly instructed in safe and efficient method?
2. Did he violate any instructions?
3. Was necessary protective equipment worn? (Example: goggles, safety belt, hard hat)
4. Did poor housekeeping contribute to accident?
5. Did horseplay cause the accident?
6. Was it caused by something which needed repair?
7. Should a guard be provided?
8. Did any bodily defect contribute to accident?
9. Was it caused by an unsafe act?
10. Did injured report to first aid immediately?

The purpose of this investigation is not to blame anyone, but rather to gain information that will help prevent repetition of these accidents. A membership in the National Safety Council was secured and posters, booklets, and tips on safety, supplied by the council, are employed regularly. Periodic safety tours are made by the committee and here again their observations are reported and discussed at the safety meeting. **End**

Above: Top photo shows member of the safety committee cautioning worker about improper method stacking material. Lower photo: No danger here! This is one correct method for locking numerous boxes together.



SEVEN TROUBLE SPOTS in Industrial Motor LUBRICATION

By R. L. NAILEN, Motor Engineering Section,
Manufacturing & Repair Div., Westinghouse Electric Corp., Sunnyvale, Calif.

ONE FEATURE sets electric motors apart from most other electrical apparatus: bearings. Improper application and maintenance of bearings can cause a lot of motor trouble. Since proper lubrication is so essential in avoiding bearing trouble, a thorough understanding of lubrication problems is an asset to the motor user.

What can go wrong? Here is a list of common troubles.

1. Grease "breaks down," or separates, so that the oil in the grease leaks away from the bearing.
2. Grease hardens in the bearing, or dries up, so that lubrication is lost.
3. In oil lubricated bearings, leakage of various kinds causes loss of lubrication.
4. Impure or deteriorated lubricating oil causes corrosion of shaft-journal surfaces or other vital parts.
5. Oil oxidizes or otherwise chemically deteriorates in too short a time, and loses its lubricating qualities.
6. False or misleading oil level readings appear in oil sight glasses.
7. Bearings overheat.

What are the results of these conditions? Noisy and eventually ruined bearings; worn and scored shafts; failed windings due to oil leaks—all represent extra maintenance and repair expense that might have been avoided. Let's look at these lubrication troubles more closely:

1. Grease "breakdown" or separation. This is caused by: Use of the wrong grease. Contaminants in the grease (dirt, etc.) Use of too much grease. Improper alignment of motor parts, excessive belt tension or thrust load—anything which overloads the bearing and causes it to run too hot. Ambient temperature too high or too low for the grease.

Probably more motors use grease-lubricated ball bearings than any other type. Isn't one grease much the same as another—does it really matter which one you use? Grease and bearing manufacturers agree that it *does* matter.

For each type of bearing, each combination of speed and load, and each range of operating temperature, there is one composition of grease that is ideal. Not only will no other composition work as well; some others may actually be harmful.

Usually recommended for the average electric motor bearing is a sodium and lithium soap grease of the so-called "channeling" type, equivalent to NLGI No. 2. The channeling feature means that as the rolling elements in the bearing sweep through the grease, they form a channel in the grease which allows the balls or rollers to pass through fairly readily yet maintains a ready supply of lubricant for them to pass against as they rotate. Such a grease should have rust-preventive ability. The least bit

of corrosion in a ball bearing may prove fatal in a hurry.

Keep the grease that you use clean. Don't let it sit around in open cans. Don't store it where it can absorb moisture. Don't let someone pack it into a bearing with dirty hands or a dirty grease gun. Dirt is bad for two reasons: first, garden variety dirt, or worse, the metal dust found in many machine shops, just won't fit through the close clearances in rolling bearings. When it gets into the bearing something has to give, and it's usually the bearing. Second: "dirt" can mean chemicals of many sorts, not necessarily gritty, which in minute quantities can destroy grease or corrode bearings.

Don't mix greases indiscriminately. Mixtures of two different types of grease can, for example, produce a combination with a lower melting temperature than that of either grease by itself.

Isn't it true that the way to keep bearings properly greased is to make sure they are supplied with an excess of grease? The answer is no. Ball bearings fail at least as often from an oversupply of grease as from a deficiency. The reason is that the churning of bearing balls or rollers through tightly packed grease in an overfilled bearing causes heating in the grease. There is no room for that "channeling" effect.

How much grease should be added? About an ounce to an ounce and a half per inch of motor shaft diameter is plenty.

Another thing to remember: When adding grease, be sure to remove drain plugs, and see that hardened grease is cleared away from around drain openings.

The two rules, "use the right grease" (meaning one that's clean and of proper grade), and "don't use too much," are so important that motor manufacturers have tried to simplify the maintenance problem by incorporating both rules in the "prelubricated" or cartridge type bearing. Such bearings are readily available in motors up to 30 or 40 hp. They are packed at the bearing factory with the right amount of the right grade, and are then fitted with built-in labyrinth seals which exclude dirt and do not allow any later relubrication.

Prelubricated bearings are ordinarily made only up through the 312 or 314 basic size. Above that, and in smaller sizes where customer preference dictates, greasable bearings are used.

If careful examination of greasing practices doesn't disclose any bad practice, then make sure the drive itself isn't the problem. Check bearing temperatures by getting a thermometer as close to the bearing as possible. Where there may be a considerable variation in duty cycle that may make the bearing loading much greater at some times than at others, do your temperature checking under the worst conditions of load.

Too much belt tension, misalignment of motor and load, end thrust higher than what the motor was designed to take—these can all contribute to overheating of the bearing. Its life will be shortened as a result.

Check the ambient temperature around the motor, too. Here again you may be surprised. Uprating of processes, use of more smaller size motors with silicone insulation and higher operating temperatures, crowding of equipment with resultant hampering of ventilation; such things may mean an ambient temperature the grease won't stand. (This is most likely to be true of the higher temperature motors.) Since standard motors are rated for operation in a 40 C ambient, make sure you don't exceed that if you expect to avoid lubrication problems. For high ambients (such as the 200 F of lumber drying kilns) silicone-base grease is necessary. Care must be taken in the maintenance procedure to see that ordinary grease doesn't get into such a motor by mistake. Sometimes low temperatures (below 0 F) may be encountered; here a diester synthetic grease is recommended.

2. Grease dried up in the bearings. This is probably due to either contamination or overgreasing. Another possibility: too long between greasings or between clean-outs of the bearing housing. Again, manufacturers' recommendations should be followed closely. The average motor, with lightly loaded bearings, in a fairly clean location, may require lubrication only once a year.

Old grease may need to be cleaned out after several such regreasings. At the other extreme of service is a type of vibrating screen drive motor requiring addition of grease every 200 to 500 hr of operation, and repacking every 2500 hr. A fair average of frequency of relubrication is a period of six months.

3. Oil leaks. These are most often caused by failure of the sealing arrangement used to confine oil in the bearing housing. There may be a number of reasons for such failure:

a. With felt seals, the seal may "glaze"; that is harden up and be beaten out away from the shaft so that rubbing contact is broken. This permits oil to pass along the shaft. Though such glazing usually is inevitable with the passage of time, it can be greatly accelerated by dirty oil or excessive operating temperature. A rough shaft surface is also hard on rubbing seals tending to abrade them.

While not so often used on motors, synthetic rubber rubbing seals are likewise subject to rapid deterioration from contaminated lubricant, overheating, or shaft roughness. These will usually become either worn or brittle and cracked.

b. With standpipe type seals, as are common in vertical pump motors using thrust bearings, leakage of oil occurs over the standpipe due to overfilling of the housing or to foaming of the oil. It may also occur due to differentials in air pressure above the oil in the bearing housing. Whereas motors expected to exhibit such a tendency are provided with venting arrangements to avoid trouble, these vents may often become clogged in service.

c. Some large high-speed motors are furnished with labyrinth seals pressurized by air from the motor blowers. The presence of the air pressure along the shaft blocks the escape of oil vapor mist. Proper functioning of this air flow system is dependent upon relatively close and accurate clearance between seal and shaft. An increase of a few thousandths of an inch in this clearance can produce leakage of oil.

4. Corrosion of shafts and bearings that seem well oiled. There are three possible causes for this sort of thing: Moisture conditions too severe for the motor design. Excessive corrosive chemical fumes in the air. Use of the wrong oil.

It used to be that it was only necessary to maintain an oil film on a surface to prevent its rusting. The corrosion inhibiting "polar com-

7 TROUBLE SPOTS

pounds" in crude oils which make the oil stick to a metal surface and exclude moisture were carried over into refined lubricating oils. However, since about 1948, almost all such oils have been refined by the processes which remove those compounds. Protection of bearing surfaces in motors require use of oil with corrosion inhibitors restored to it.

5. Oil oxidizes or otherwise deteriorates. The usual reason for this is overheating (see No. 7 below), but it may also be caused by use of the wrong oil. When normal operating temperatures can reach 150 to 200 F, as in some heavily loaded thrust bearings, use a grade of oil which contains the necessary antioxidation additives that prevent premature formation of carbon, "varnish," and sludge.

Another cause is exceptionally dirty or chemical laden atmospheres resulting in rapid pollution of the oil. Bearing housings are not airtight. If that kind of condition is something you must live with, make frequent checks of the oil condition and change it before it gets too bad.

6. False or misleading oil level readings. Motor bearings do not run submerged in oil. It isn't necessary for proper lubrication, it would cause too much oil heating, and the sealing problem would be formidable. Therefore, a most important part of proper lubrication is maintenance of the correct oil level in the bearing housing. There are two common means of doing this (besides the familiar oil cup): 1 "constant" level oiler; and 2. visual sight glass.

Working of the oiler is shown in Fig. 1a. Any drop in housing oil level breaks the oil seal at the mouth of the bottle spout, allowing air to enter the bottle and oil to flow from the bottle into the bearing housing until the level there is restored. Such a device does not have the advantage on modern motors that it did for older types of machinery in which oil leaks weren't so often fatal, and is not recommended for large motors. But it does provide a clean and convenient means of filling bearing housings when changing oil.

Significant lowering of oil level during motor operation means troubles that the oiler cannot correct, but it will serve to keep an unattended bearing going until a seal that is just beginning to leak can be replaced.

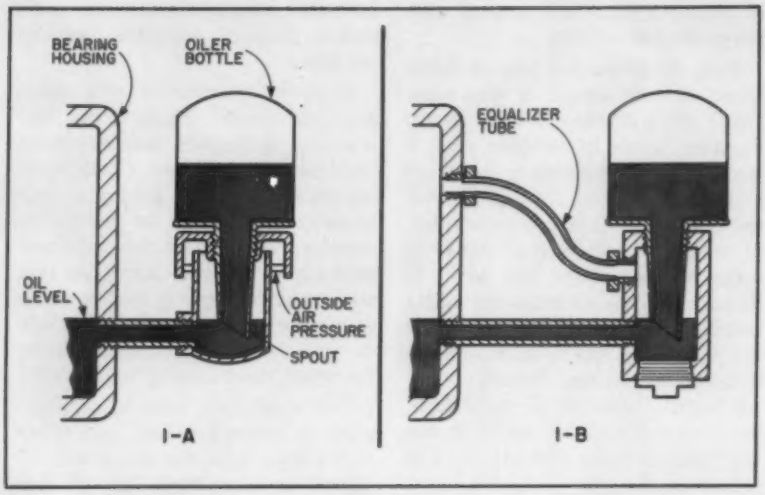


Fig. 1a. This constant-level oiler permits oil to flow into bearing housing when oil seal is broken at spout. Not recommended for large motors. Fig. 2a. The equalizer tube is useful in maintaining the same air pressure in the oiler as in the housing. Pressure in the housing, in 3600-rpm motors may, due to motor ventilating system, drop below atmospheric, draining the oiler.

There are three things to remember about oilers:

a. The level visible in the oiler bottle does not represent the level in the bearing housings; changes in the bottle level do not mean changes *of the same amount* in the housing level.

b. Use of a standard size oiler on large motor thrust bearings is pointless. When a bearing housing holds several gallons of oil, an oiler containing only a few ounces would be exhausted by a very small change in housing level. Large oiler bottles can be had, but they form a cumbersome and costly accessory.

c. On 3600-rpm motors generally, and at other speeds depending on physical size, the motor ventilating system tends to produce pressures below atmospheric in the bearing housing. The higher pressure acting on the oil level around the oiler spout will then cause a forcing down of that level. A gradual flow from the bottle into the housing will then continue until the bottle is empty—all the oil having gone to raise the housing level above its normal position. To prevent this, special oiler construction, Fig. 1b, with equalizing tube is used. If tube or fittings become clogged, or loosened so as to admit outside air, erratic performance will result.

Fig. 2. Sight glasses or gages are used more widely than constant-level oilers. They may be either the elbow type or the bulls-eye type above.

Sight glasses or gages are more widely used. They may be the elbow type or a bulls-eye such as Fig. 2. As shown in the illustration, it is common to mark such gages with two oil levels—the "idle" level to be observed when the motor is idle, and the "running" level. To avoid overfilling, it is best to add oil when the motor is stopped, and to fill only to the "idle" level.

The elbow type gage has the advantages of being less sensitive to foaming or splashing inside the bearing housing and of furnishing a convenient means of filling and draining the housing. However, it does depend, for proper level indication, on

reasonable equality of air pressure inside the housing with that inside the gage. Here again equalizer tubes may be used. Just how tricky this pressure equalizing sometimes gets is shown by Fig. 3, illustrating the bearing housing ventilating scheme used on some vertical motor thrust bearings.

Mention has been made of oil foaming. Besides making it difficult to read oil level, this can disrupt operation of oil pumps in forced lubrication systems including vertical motors where the bearings themselves furnish the pumping action. In a properly designed bearing assembly, foaming is usually caused by use of the wrong oil, or by contamination in the oil. Very small amounts of unsuspected impurities have been known to produce foaming on otherwise stable oil.

What is the right oil? See Table I for general recommendations.

Table I. Recommended oil for lubrication of various types of motor bearings.

TABLE I

Type of Bearing	Rated Speed, RPM	Oil Viscosity in Saybolt Seconds Universal (SSU) at 100 F	Approximate Equivalent SAE Number
Sleeve (self or ring lubricated)	Up to 3600	180-250	10W
Sleeve (forced or flood lubricated)	3600	140-160	5W
Anti-friction; horizontal motor	Up to 1200	457-550	20-30
Spherical roller thrust bearing (vertical motor)	Up to 1200	1000-1500	40-50
Spherical roller* thrust bearing (vertical motor)	1800	900-1000	40
Ball thrust bearing (vertical motor)	Up to 1800	200	10W
Kingsbury thrust bearing (large vertical motors)	Up to 5000 ft/min at bearing O.D.	275-325	20W
	5000 ft/min & above at bearing O.D.	180-250	10W

*Bearing housing must be water-cooled to prevent overheating of oil. Extra oxidation inhibiting additives will be needed in the oil.

7. Bearings overheat. How hot should a bearing get? In the average horizontal motor running unloaded, bearing temperatures should level off at about 5 to 25 C above ambient, the higher temperatures applying at higher speeds. Under full motor load, bearings should run 15 to 20 C below the winding temperature. Bearing temperatures above 85 C, including ambient, are dangerous.

For 3600-rpm motors of 100 hp or more, no load bearing temperature will be 25 to 40 C above ambient. These will usually have forced lubrication systems to carry away bearing heat.

Vertical pump motor thrust bearings tend to run a great deal hotter, and are more influenced by bearing loading than by horsepower output of the motor. Spherical-roller, oil-lubricated thrust bearings can safely run at 100 C. Such service requires a very heavy oil (viscosity of 1000 to 1500 SSU at 100 F, about SAE 50, is used in such thrust bearings.) At this high operating temperature, a light oil would have little more lubricating value than water.

Hot bearings are caused by: Use of the wrong lubricant. Mixing of different grades of lubricant. Overlubrication. Dirty oil or grease. In sleeve-type bearings, worn oil rings which do not rotate properly to keep the journal oiled. Malfunctioning of metering orifices controlling oil supply to bearings (usually in vertical motors). Obstruction of some portion of motor ventilating system (which may also cause winding overheating). Air leaks or other failure in piping or pump of forced lubrication system. Misalignment, excessive belt tension, or other drive condition not directly related to lubrication. Excessive ambient temperature.

While many of these conditions won't always cause immediate bearing failure, abnormally high bearing temperature is evidence that something is wrong that should be found and corrected without delay. **End**

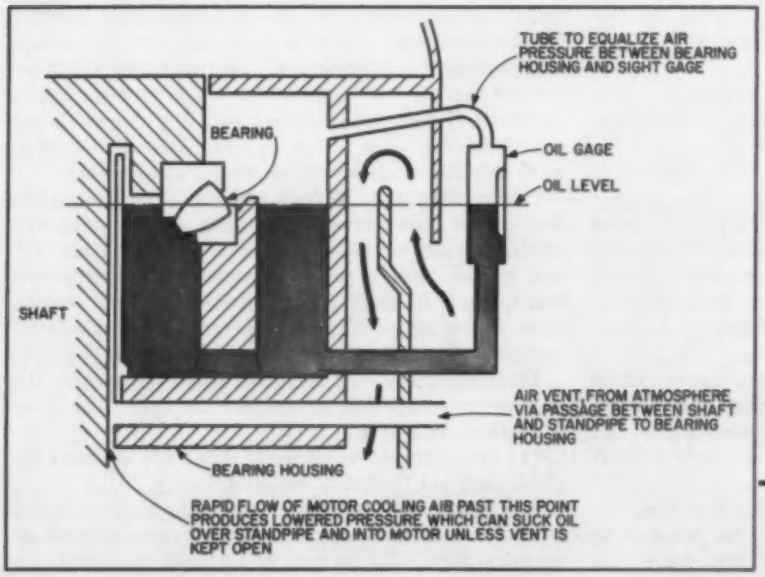

TUBE TO EQUALIZE AIR PRESSURE BETWEEN BEARING HOUSING AND SIGHT GAGE
BEARING
OIL GAGE
OIL LEVEL
SHAFT
AIR VENT FROM ATMOSPHERE VIA PASSAGE BETWEEN SHAFT AND STANDPIPE TO BEARING HOUSING
BEARING HOUSING
RAPID FLOW OF MOTOR COOLING AIR PAST THIS POINT PRODUCES LOWERED PRESSURE WHICH CAN SUCK OIL OVER STANDPIPE AND INTO MOTOR UNLESS VENT IS KEPT OPEN

Fig. 3. Sectional view of thrust bearing assembly on vertical pump motors. Large arrows show path of air.

Do They Read YOUR Reports?

IF NOT | then here are some simple rules to follow to make your report concise, complete and to the point

By **Lawrence Mann, Jr.**, Assistant Professor in Educational Engineering, Louisiana State University and Agricultural and Mechanical College

WHETHER we are writing a half-page inter-office communication or a detailed description of our ideas for a better maintenance plan, we would like to believe that those who are responsible are going to read our reports. Let us back off and take a good look at the report per se.

A report should tell in a straight forward and logical manner the story of what we have done or what we have found. We write reports for two reasons:

1. Reports are written as the culmination of an investigation so that authority can use the work as a basis for decision.

2. Reports are written to gather and systematize related data for future use.

In either case, unnecessary length and useless charts, graphs, pictures and appendices only clutter up the work to the extent that it is only half read or not read at all.

Frequently, individuals stretch out reports in hopes of making a favorable impression on those in authority. They actually accomplish the opposite aim. Rare indeed is the individual who can "tell the story" in a short, complete manner.

The main purpose of a report is to set forth a group of facts known by one individual or group to another individual or group. The work is satisfactory only when it adequately accomplishes this. A good report is characterized by completeness, organization, conciseness and summary.

A report is not complete unless all variables which affect the problem are considered. Perhaps the greatest fault of reports is their lack of consideration of all points which are necessary in order to arrive at a valid solution.

It is absolutely essential that one has a firm basis for all conclusions and deductions. Always be prepared to answer such questions as "How can you make this statement?" or "Why do you recommend this course of action?" or "Where did you get this figure?"

Consider that the cost factor is usually the dominant one. Because of this, it is only logical that the basis for all comparisons should be reduced to a dollars and cents figure.

For instance, if one is trying to justify a new piece of equipment, all cases should be reduced to a costs or savings per year basis. Remember, for easy, rapid comparison, all alternates should be on the same basis.

How Much Time Should Be Spent on a Report?

Let us now reflect on how much time we should spend on our report. If we are considering whether or not to purchase a piece of equipment and the savings is approximately $3000 a year, then naturally this does not call for a detailed study that would cost thousands of dollars. It is a good idea to establish a rule of thumb by which you can judge approximately how much effort you should put on various investigations.

Let us illustrate. Take a number of investigations that you or others have previously made. Tabulate the estimated costs or savings of each project. These figures should cover a range of projects. Now ascertain how many man-hours were expended on these reports. Then plot a curve. The shape of your curve should be similar to the general curve shown in Fig. 1.

There are many aids and tools which will enable the engineer to collect and systematize the data. The three to be discussed here are:

(1) Graphical presentation of data; (2) Systems analysis, and (3) Statistical methods.

Perhaps the most widely used tool of presentation is that which converts information from tabular to graphical form. Graphs may be pictorial or quantitative

in nature. Pictorial presentations can be drawn to scale but their pictorial aspect is of greater importance than the quantitative measure.

We are mainly interested in the graph in which the quantitative aspect is of primary importance, i.e., the presentation of the quantitative information is the purpose for which the graph is drawn. Consider the simple table shown on the next page.

It is not possible to pick out the high months, low months and general trends from the table. Even though this is a very simple tabulation, a certain amount of study must be made to absorb the meaning.

Let us present the same information in a graphical form. See Fig. 2.

It can immediately be seen that one glance gives the complete story. The ability to reduce a quantity of data to graphical forms of presentation is one that should be developed by all who habitually write reports.

The second tool to be discussed is the use of mathematical models. The mathematical model is usually a set of equations relating significant variables in the problem to the outcome. With the advent of linear programming and operations research, increasing use is being made of mathematical models.

This method of presenting and solving problems is adapted to those which contain many interrelated variables. Reports, which recognize all the variables affecting a problem, arrange them in logical order, apply the proper weight to each one, then mathematically process the resulting equations, are exceedingly helpful to management who must use the resulting work as a basis for making decisions.

The simple and well-known problem of determining the most economical way to distribute a product to X customers from Y warehouses will serve to illustrate this method. By arranging the shipping costs per unit in a simple matrix and using a systematic algebraic method of iteration it is possible to optimize the solution so that the distribution costs are at a minimum.

This method, known as linear programming, does not necessarily require the use of computing equipment. Many problems can be solved manually in a short time.

Other production problems such as a manufacturing situation with a number of courses of action, a refinery blending problem where the motor oil contains a number of components all of which affect the specification and many other problems lend themselves to this type of solution.

The third tool is statistical methods. In many investigations it is necessary to take a group of data which is a sample of a larger amount of data. From these figures conclusions are drawn. These figures often form a basis for future action.

In view of this, we must have some method for determining just how much confidence we should have that this set of data represents the entire problem. This is but one of the ways that statistical methods can help us define our problem. Correlation coefficients tell us just how well one variable is related to another. Lines of regression tell us the relationship between a factor and a given set of results.

The Brief and the Comprehensive Report

Now that we have defined our problem and recognized some of the aids in solving it, let us consider the report itself. For the purposes of this discussion let us classify reports into two types; (1) the brief report and (2) the comprehensive report.

The brief report is one used to convey the fact that an investigation has been performed along with the results of that investigation. It can be either a routine matter or one for which a special request has been made. It usually requires no action on the part of management but only serves to notify them that something has been done. The brief report shown in Fig. 3 illustrates this.

The second type is the comprehensive report. This work can vary from a few pages to a work the size of the Manhattan telephone book. Although reports of this nature vary greatly from plant to plant, a certain general pattern has emerged from a study of a number of these. The comprehensive report should include the following sections:

(1) Cover letter (letter of transmittal), (2) front page, (3) table of contents, (4) body, and (5) appendix.

It is felt that these five parts are a minimum, and sections such as: Index, Abstract, Explanation of Terms, Forward, Preface, etc., are often necessary to improve the coherence of the work.

The cover letter is addressed to the individual, group or committee that requested that the investigation be made. Here is a good place to sum up the results of the research. This avoids the necessity of an abstract or summary within the report.

In addition, the cover letter should indicate whether

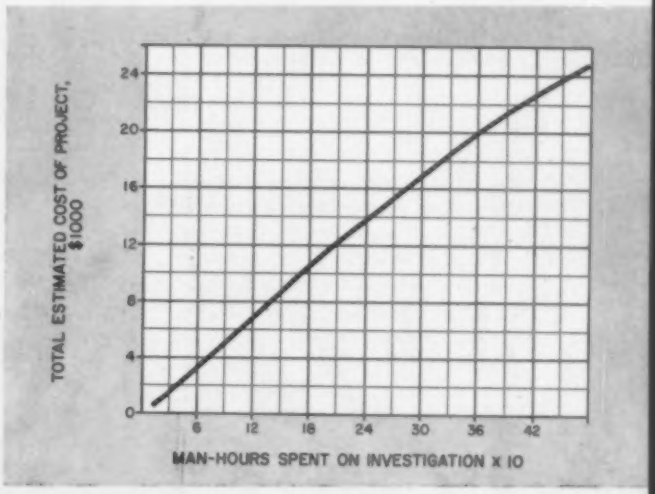


Fig. 1. The number of man-hours expended on reports based on estimated costs of savings of each project should follow a similar pattern to the curve at right.

the author feels that his obligation has been fulfilled completely or whether additional work is necessary. If the author has any recommendations that he wishes to make, they should be summarized in the cover letter.

The front page should include:

(1) title of report, (2) author and his position, (3) name of recipient of report, (4) date and place (origin of report), and (5) designations such as budget item, project number, etc.

Table of contents is a topical outline of the investigation with the appropriate page numbers. From this section the reader can learn what subjects are covered in the report. He can also use the table of contents to locate that section of the work in which he is interested.

The complete development of the report is located in the section called the body. The first task of the author when constructing the body of his work is to present the data which justify his conclusions and recommendations. This is the essence of his work.

In the appendix include material which is necessary for the completeness of the report but which will not be required by the reader to understand the work.

In summarizing, let us emphasize five points.

(1) It has been said that a problem well stated is half solved. This is nowhere more true than in technical investigation and the resulting compilation of the data.

(2) The presentation of the report often strongly affects its value to management.

AJAX CORPORATION
2001 SMITH ROAD
BATON ROUGE, LOUISIANA

Subject: Portable air compressor No. 203
Date: June 3, 1960

The air receiving drum for No. 203 portable air compressor was inspected and subjected to a hydrostatic test of 190 psig on May 30, 1960. The drum was found to be satisfactory for further service and will be due for another inspection in May, 1962.

Inspector: LHC

Approved _____
W. T. Briant

Joe Smith: bg
CC: Mr. R. C. Colt (2)

Fig. 3. Sample shows what a brief report should contain.

(3) Consider the background of the person receiving the report and use nomenclature and definitions consistent with his degree of knowledge on the subject.

(4) Remember that the report deals with facts. No unsubstantiated or undocumented data should be included.

(5) When one considers the amount of time that is spent in industry today in organizing, writing, typing and reproducing, distributing and reading reports, it can readily be seen that this is an area that warrants efforts toward improvement. **End**

Cooling Tower Makeup Water (1000 cu ft/month)

January	10.2	July	20.5
February	10.0	August	21.5
March	11.1	September	18.2
April	11.0	October	17.8
May	15.2	November	14.3
June	18.6	December	13.7

At times, tabular material may not tell a story as well as a graph might.

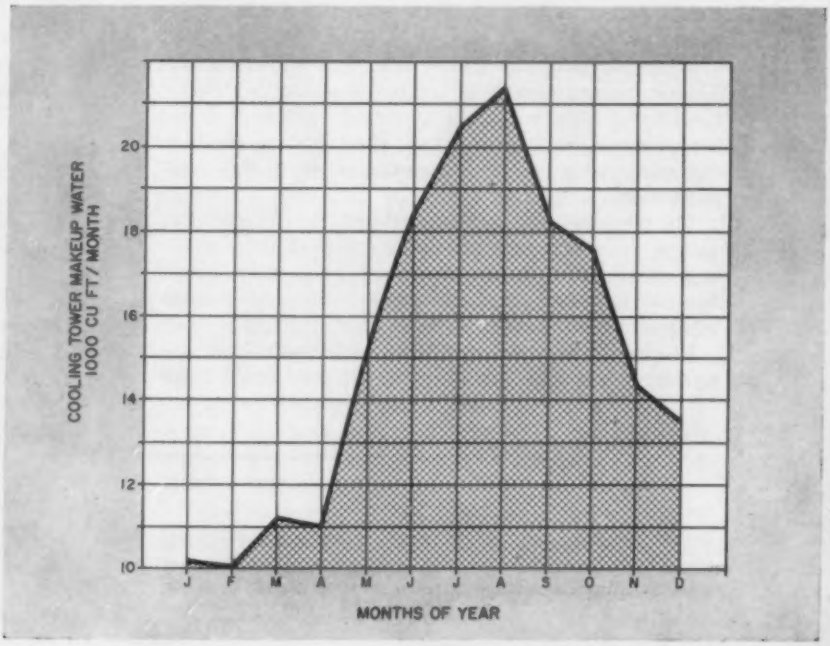


Fig. 2. You can notice the difference when data is presented graphically.

Plant Engineers Jack Up the Floor,

CUT BASEMENT DOOR THROUGH CONCRETE GIRDER

By **G. W. GIARD**, Engineer,
Plant Facilities
General Electric Co.,
Richland, Washington

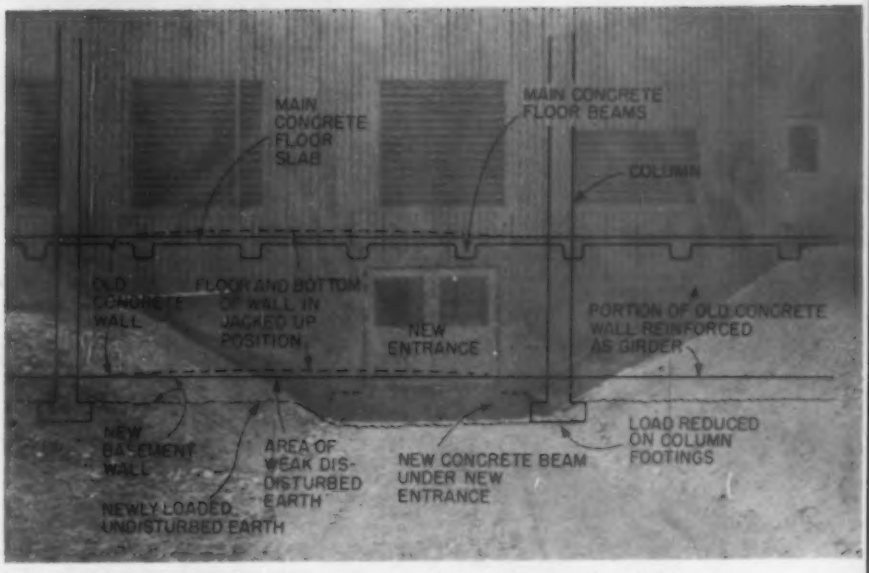

MAIN CONCRETE FLOOR SLAB
MAIN CONCRETE FLOOR BEAMS
COLUMN
OLD CONCRETE WALL
FLOOR AND BOTTOM OF WALL IN JACKED UP POSITION
NEW ENTRANCE
PORTION OF OLD CONCRETE WALL REINFORCED AS GIRDER
NEW BASEMENT WALL
AREA OF WEAK DISTURBED EARTH
NEW CONCRETE BEAM UNDER NEW ENTRANCE
LOAD REDUCED ON COLUMN FOOTINGS
NEWLY LOADED UNDISTURBED EARTH

Fig. 1. Color overlay shows position to which existing wall and floor were bent upward and held by jacks. Overlay also indicates new basement wall and beam. New double-door entrance was cut out of reinforced concrete.

OUR PROJECT was to provide an outside entrance and a new basement room under a large physics and metallurgy laboratory building. The wall through which the door was to be cut, while it looked like an ordinary foundation wall, was actually a large reinforced concrete girder supporting the exterior wall of a steel building and the ends of several reinforced concrete floor beams, which supported the building's main floor.

The designers of the original structure, apparently unsure of the uniform bearing capacity of the soil, had made continuous girders of the foundation, to bridge over soft spots in the ground. Their problem had been complicated by the extremely uneven weight distribution; parts of the building were bulky and light, while other portions were relatively dense and heavy. Adequate footings under the heavier portions would support those parts of the building, but would tend to leave the lightest parts floating too high. Even with the bottoms of the walls bearing on the ground, these light portions would not settle.

The continuous girders solved this problem by carrying all the building weight to columns, under which foundation footings were sized more exactly in proportion to the building weight that each carries. This enabled the building to float more uniformly on its cushion of earth, reducing the hazard of uneven settling and cracking. The building's girder-walls were prevented from bearing directly on earth by construction of wood forms on their bottoms. The soil below them had to be excavated to enable the carpenters to install the wood forms. After work was completed, the earth was backfilled—leaving the soil fluffy and weak and unable to exert an upward pressure on that portion of the building.

Since the building was now several years old and settlement substantially accomplished, it seemed reasonable to assume that this wall was no longer needed as a girder, and could be converted to a bearing wall. This would take a lot of weight off the column foundations, but then things floating on earth do not rise much when the load is lightened, as does a building resting on a swamp or a ship on water. It also seemed possible to transfer the load that we would take off the columns to the ground under the wall. Bending the wall upward with jacks (as much as possible, but not enough to crack the main floor above) and holding it there, we could extend it downward by pouring a concrete wall under it to reach down far enough to accommodate the new basement floor to be built below. In extending the wall downward, we would at the same time be getting below the fluffy, weak soil under the existing beam to stronger, undisturbed ground. We could further enhance the strength of this ground by compacting it.

After the new bottom portion of the wall was poured and the concrete cured sufficiently, we planned to let the upward bend out of the wall and main floor by removing the jacks. At this time, the wall would press downward, forcing its way a short distance into the earth, thus compressing, and increasing soil resistance until it equalled the weight of the building. In the meantime, before removing jacks, we would cut an opening for a doorway and pour a reinforced concrete beam under the doorway, mono-

Fig. 2. Re-grading of approaches to building was necessary to allow access to new basement through door.

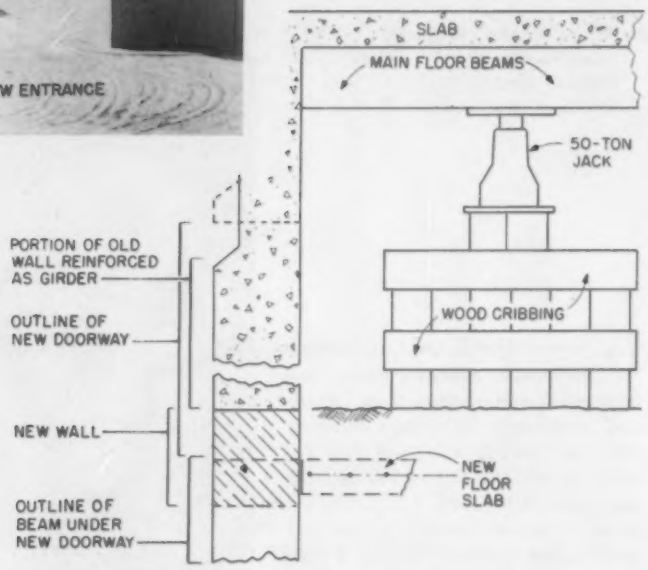


Fig. 3. Cross-sectional drawing of jacking setup. Cribbing laid on existing grade under main floor supported jacks that lifted main floor and portion of reinforced girder-wall. After new wall was poured, jacks were removed, floor and girder allowed to return to original elevation.

CUTTING THROUGH CONCRETE GIRDER

lithically with the new wall, so the ground would carry its share of the load when the jacks were removed.

An additional item in our favor was the fact that the girder was continuous (negative reinforcement through supports). The remaining end portions of the girder would tend to act as cantilevers after being severed to provide for the door opening.

We proceeded on this basis. Jacks were placed on cribbing just inside the girder, under two of the reinforced concrete floor beams. It was necessary to adjust the jacks frequently for a few days to compensate for ground settlement under the cribbing (yielding of the soil to the load on the jacks). A constant upward deflection was maintained without difficulty.

The jacking process was simplified by the fact that the reinforced concrete floor was integral with the wall (see sketch). There was sufficient steel in the concrete to resist the upward thrust of the jacks, although we did substantially exceed allowable working stresses, especially in shear. We stayed within the elastic limit of the steel and within ultimate shearing strength (diagonal tension) of the concrete. By using ordinary deflection formulas, we calculated that a 60,000-lb upward force from each of two jacks would produce an upward deflection of about 1/10 in. in two of the reinforced concrete floors beams and that the wall would gradually yield to this force as the doorway was out. The girder-wall was too strong to yield as a continuous girder, but would yield as the cutting reduced its strength to that of a cantilever.

The 1/10 in. was somewhat arbitrary as we made no special study to arrive at this deflection and/or allowance for settlement. We felt, however, that our experience with the settlement problems (or lack of them) in the area, qualified us to use judgment in this case. The jacking was accomplished, as indicated in the sketch, with two 50-ton mechanical jacks; mechanical, rather than hydraulic, because of the need to maintain and adjust for a constant upward displacement for an extended period of time.

The actual cutting was accomplished by line drilling the boundary of the opening with a wagon drill and then breaking out the central portion with a 90-lb pavement breaker. Reinforcing steel was cut as encountered with an oxyacetylene torch. A chipping gun was used to trim the opening.

When the building jacks were removed and the heavy floor and wall were lowered and had settled, we knew the effort had been a success. Hair-line cracks which were in evidence before the job was started did not widen. The new basement floor slab was then poured, separated from the new wall by a mastic joint.

General Electric plant engineers at Hanford were able to take care of a unique combination of circumstances to provide a new entrance under a large industrial building, and at the same time acquire new basement space at a fraction of new-construction cost. **End**

Don't Write, Don't Wire . . . DO BOTH!

MAINTENANCE ORDER TRANSMITTER HAS MANY PLUS VALUES

By **S. N. CHEW**, General Foreman
G. G. BRIXIUS, Staff Engineer
Both of Property and Maintenance, Long Beach Division,
Douglas Aircraft Company

WHEN TROUBLE, which requires the attention of maintenance personnel, occurs anywhere in the big 270-acre Douglas Aircraft Company plant at Long Beach, California, a single telephone number is called. Simultaneously with the announcement and description of the trouble, a maintenance work slip is generated in the maintenance crib in the area where the trouble exists. By the time the caller hangs up, the foreman in the affected crib may be reading the slip, making the assignment, and slipping it into the proper pocket on the job assignment board.

This is not magic. . . . .It's merely the result of a TelAutograph system installed by the Douglas Long Beach maintenance department in 1960.

However, the system does more than speed t r o u b l e calls to their proper destination. After the work slip has been properly filled in by the employee who does the job, it provides information for complete analysis of the job, the efficiency of the mechanic who accomplished the work, total costs involved, and lists valuable data for posting to vital machine records.

Before the wired system was installed, the maintenance department listed some 14 telephone numbers which could be called in the event of trouble. When a production worker needed maintenance aid, chances are he could not remember any one of the 14 numbers, or if he could, he would call the wrong number for the type of maintenance work that had to be done. This resulted in confusion and delay in getting the call through to the proper crib. In the meantime, an expensive machine would be suffering downtime while the confusion was being eliminated. Furthermore, the work slip finally made out and handed to the mechanic who would do the job was an assignment slip only and furnished little or no information for vital records after the job was completed.

The system now in use consists of a central desk with two operators and two transmitting units. The telephones on this desk operate on the rotary system, and up to five telephone calls at one time, all coming in on the same telephone number, can be handled. Thus production personnel have only one maintenance telephone number to remember.

When a trouble call is received at this central desk, the operator notes at once from which one of the plant's five maintenance areas it is originating. The maintenance crib in each of these areas has its own receiver, or transcriber unit. The operator then codes the outgoing message so that it will go to the right crib.

As the caller describes the trouble to be corrected, the operator transfers this information, in longhand writing, to a slip in the transmitter. Concurrently, the transcriber in the affected maintenance crib duplicates the information, again in longhand writing, on a Douglas-designed work slip, and signals that a message has been received. The assistant foreman in the crib then notes the type of trouble involved, tears the slip from the transcriber, assigns the work, then files the slip under the name of the assigned mechanic on the assignment board.

(Please turn page)

Two transmitter operators receive all the maintenance phone calls, code each call according to maintenance area in which it originates, then fill out in longhand the transmitter work slip. At the other end of the line, in the maintenance tool crib, the work slip is being duplicated. Work slips are detached, assigned to proper personnel, filed in assignment board.

MAINTENANCE ORDER TRANSMITTERS

If no one happens to be in the maintenance crib when a message is received, they merely accumulate at the transcriber until someone with the authority of assignment does arrive. This is another distinct advantage of the system—it is not necessary for someone to be continually in attendance to receive trouble calls as it was when telephones were being used.

When a mechanic takes his work slip from the assignment board, he notes the type of work to be done, then punches the starting time on the slip. He also punches the same slip in when the job is finished. He notes on the slip what was accomplished, and any job peculiarities that occurred. These slips are returned at the end of each day to the central maintenance office where each job is completely analyzed.

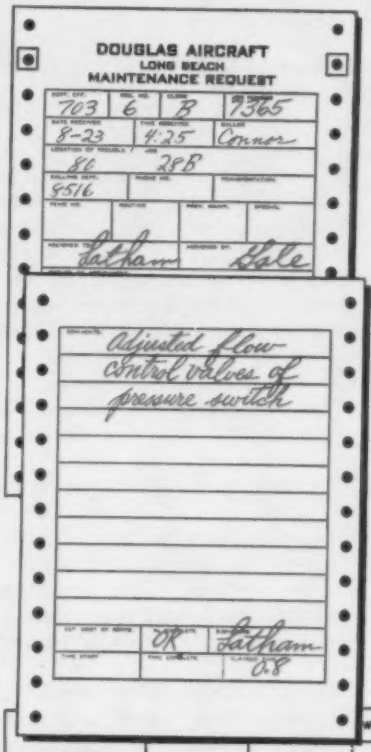
One of the work slips is shown on this page. It does not take much imagination to visualize the vast amount of vital information these finished work slips can furnish when they are analyzed on a cumulative basis by posting various factors to specific work sheets.

The average time required for certain repetitive jobs can be quickly determined. This figure can be used for determining the relative efficiency of various individual employees. This alone, along with the general knowledge that such an analytical potential exists, has increased over-all maintenance employee efficiency 30 to 35 per cent since the system was installed.

Postings can be made from these slips to individual machine records. Thus it soon becomes evident when a specific machine is requiring too much maintenance work. Further investigation at this point will reveal whether the machine needs a complete overhaul, rebuilding, or should be replaced. Certain types of maintenance work may occur so often that a complete renovation or installation will prove more economical. This will be indicated by accumulated data from the work slips. Typical cases might be an overloaded electrical circuit, air pipes that were continually fouling, or a conveyor that kept breaking down and delaying a production line.

From the cost angle, monthly rental charge on the TelAutotype equipment, which includes maintenance, is only slightly greater than was the monthly telephone service charge on the telephones the system replaced. Cost of the Douglas-designed work slips is negligible. No hiring was required at the time the system was installed. In fact, several jobs were consolidated instead, along with the fact that the automatic Telescriber in each maintenance crib releases a crib employee from constant attendance.

So in over-all perspective, and with all factors considered, total costs in conjunction with the use of the system are about the same as telephone costs before the installation. The many advantages of the system described in this article are a bonus, so to speak, insofar as operating cost outlay is concerned. **End**



DOUGLAS AIRCRAFT
LONG BEACH
MAINTENANCE REQUEST

703	6	B	7365
8-23	4:25	Connor	
86	28B		
8516			
Latham		Hale	

Adjusted flow control valves of pressure switch

OK Latham 0.8

Right: Actual copy of work slip. When it is properly filled out, it contains much vital control information.

Above: Authors Brixius (left) and Chew, analyze completed work slips.

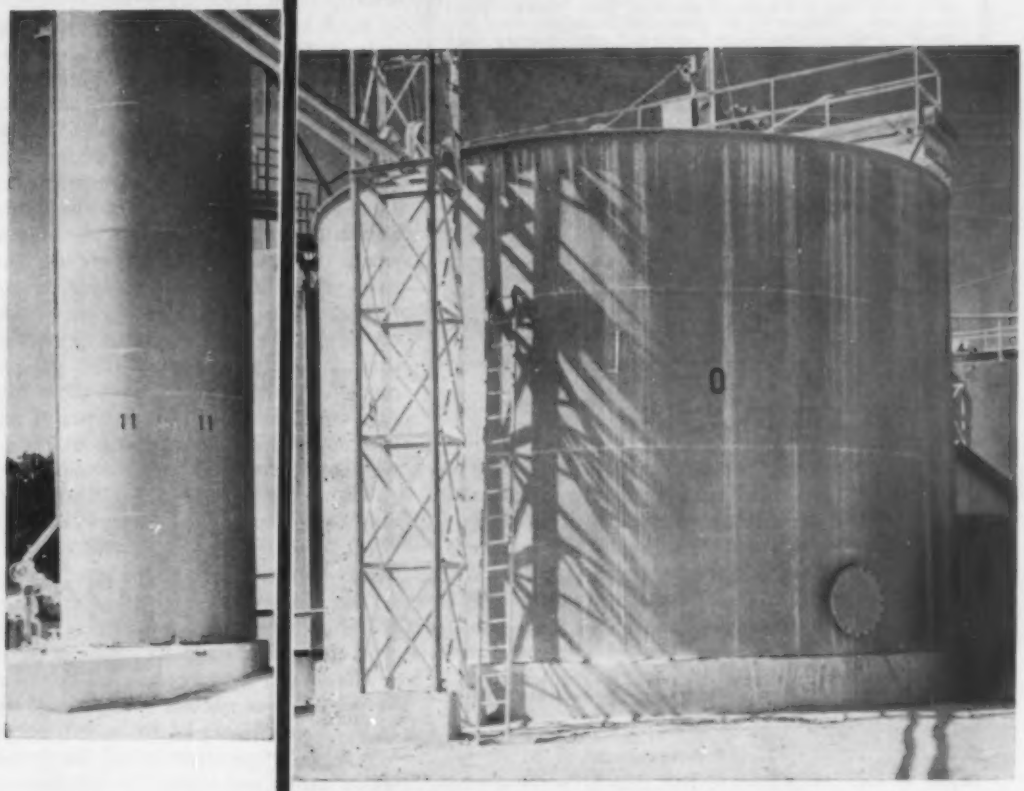
Right. This is the type of sheet used by Douglas maintenance for analyzing one week's total transmissions.

WEEKLY RECAP OF TEL-AUTO SLIPS

DEPARTMENT	DATE	DATE	DATE	DATE	DATE	WEEK TOTAL
TROUBLE CALL						
ROUTINE						
PREVENT. MAINT						
PEMO						
SPECIAL						
TOTAL						
TROUBLE CALL VIA TEL-AUTO						
TROUBLE CALL HANDWRITTEN						

	JOB SLIPS	HOURS TOTAL	MEN PER DAY	JOB SLIPS	HOURS TOTAL	MEN PER DAY	JOB SLIPS	HOURS TOTAL	MEN PER DAY	JOB SLIPS	HOURS TOTAL	MEN PER DAY	JOB SLIPS	HOURS TOTAL	MEN PER DAY			

EPOXIES fight ACIDS



Vessel at left, above, was protected with two coats of epoxies at same time one at right was coated with another material. Three coats of epoxy are used on insides of vessels where corrosion is the greatest.

Protect Concrete and Steel

By **HAROLD E. DAVIS**, Superintendent of Services
Minerals & Chemicals Corp., Menlo Park, N.J.

AT THE McINTYRE, Georgia plant of Minerals & Chemicals Corporation bleaching of raw clay is done with a sulfurous acid bleach liquor having a pH of 2.3. Acid liquor, moist acid fumes, and dust particles are corrosive factors everywhere at nine of the company's plants. Although acid concentrations tend to taper off with increasing distance in the process from the bleaching operation, pH ratings as low as 3.4 and 4.5 are found.

To assure product quality and minimize the cost of replacement of equipment, we began a search for a coating to solve these corrosion problems. In the last eight years many different protective coatings have been applied to steel and concrete equipment. Only one coating has given protection for any length of time.

In several of the most corrosive locations, an epoxy resin coating was applied two years ago. This coating is still intact and looks as good as new. Its condition seems to promise protection for possibly 8 to 10 years.

The corrosion problem at our plants is difficult for several reasons. The process is continuous, and one in which downtime is a costly proposition. When an item of equipment is taken out of operation for cleaning and coating, we never have more than five working days to complete the job. This is not enough time to prepare the steel and concrete properly, and to apply three coats and permit each to dry thoroughly.

Consequently the second coat is applied while the first is tacky and the third coat is applied before the second is thoroughly dry. The equipment goes back into operation while the third coat is still soft. We allow only two days for the three coats, including curing time.

Surface Preparation

Another complication in our corrosion problem is that the steel and concrete surfaces cannot be prepared with conventional techniques. We can't sandblast—for fear that blast product residues would remain and contaminate the product. So, cleaning is done with impact tools to

What are Epoxies?

Epoxy resins were the result of laboratory attempts to create a synthetic resin structure that would produce coatings with greater adhesion, flexibility and chemical resistance than any film-forming material then known. The epoxy resin (related to the phenolics, Bakelite) may be cured (solidified) by many reactants, most notably the amines and polyamides (related to the nylons). The union of these two outstanding types of plastics is primarily responsible for the very versatile "epoxies." Because the reaction between epoxy resin and curing agent is one of "addition," there is neither an increase nor decrease in volume to disrupt adhesive bonds or cause stresses within the film.

Due to the high degree of reactivity between the epoxy resins and curing agent, it is necessary to ship and store the resins in two separate containers. Once the two solutions are mixed (usually a one-to-one or two-to-one mixture) the "pot-life" is approximately twenty-four (24) hours. Thereafter sufficient reaction has occurred between the materials to impair the properties of the final film.

The above information was provided by J. F. Beegle, Hauger-Beegle Associates, Inc., Chicago, Ill.

EPOXIES FIGHT ACIDS...

scale down the heavy deposits, followed by rotary mechanical tools and wire brushes. Finally, residues are swept out and the last traces are blown out with air.

Three days are taken for cleaning and preparation, but concrete settling tanks do not dry out in that time. When the first coat is applied the concrete is still damp. Settling tanks are big concrete bowls, about 100 ft in diameter and 15 ft deep at the center. Before we protected the tanks with epoxy, concrete was sometimes eaten away by the acid to depths of as much as ⅜ in.

Our first application of any epoxy coating was in a dust collector where, at a temperature of 225 F with peaks as high as 320 F, several tons of acid-containing water are evaporated per hour. After two years under these conditions, the coating still protects the steel. Adhesion is apparently as good as the day the coating was applied. There is no indication of flaking off and the coating did not waste away from the outside. This is probably one of the most difficult service conditions for a protective coating.

When our 4-man paint crew starts to clean and coat an equipment unit, we know that the maximum time that can be expected for the job is five working days. If it happens to be a settling tank, the first thing that is done is to pump out the clay and liquor after mixing it into a slurry again. Then it is generally hosed down to remove as much of the clay as possible. Following that, the crew is ready to move in with impact and rotary tools to try to scale the surface down to its original condition.

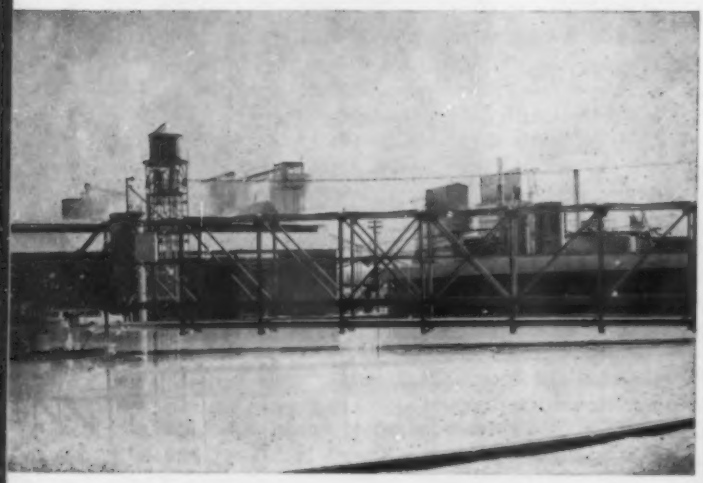
By that time the concrete is semi-dry and the crew begins to put on the first coat. We use an epoxy red oxide primer on steel, but no primer on concrete. Three coats of epoxy are applied where coating service conditions are most difficult, as on the inside of steel tanks and in the settling tanks. On the outside of tanks, and where atmospheric conditions are less corrosive, only two coats are applied. Each coat is put on in a different color.

The coating is applied by conventional paint spray equipment. We use the coating formulation without thinning as long as the spray guns will pass it at normal pressure. We thin it a little when the prevailing temperature drops. Several different types of nozzles have been tried out. A No. 19 nozzle fans out into a wide spray pattern that covers uniformly and quickly.

We use the Adheron Series 1000-1 epoxy maintenance finishes, formulated by Hauger-Beegle Associates, Inc., Chicago., employing a polyamide curing agent. These finishes are formulated for the most adverse conditions of surface preparation and moisture. They are based on Shell Chemical Company's Epon resins. In this series, resin and curing agent are mixed in equal proportions.

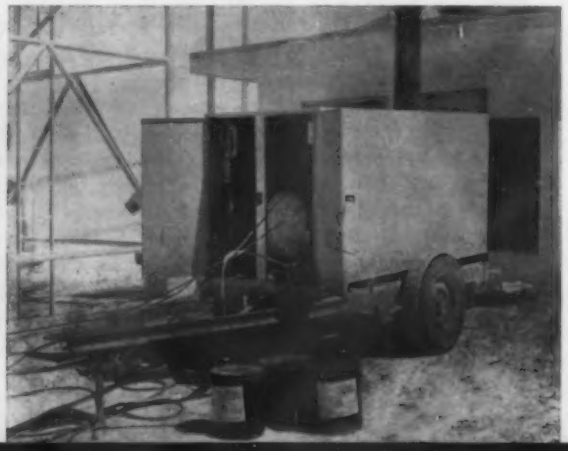
The coating is usually batched-up in 5-gal lots, to avoid having left-over mixture at the end of the day. Once the resin and curing agent are mixed, pot life is 24 hours. When the temperature is hot, the formulation tends to set-up earlier and it can't be left overnight in gun, hose or pot. The final coat is permitted to cure between 12 and 24 hr, depending on temperature conditions. Then, while coating is soft, equipment is returned to service.

Gradually, as downtime permits, we expect to coat with epoxy all settling tanks, all steel tanks inside and outside, all structural and other steel throughout the nine plants wherever acid liquors, moist acid fumes and dust threaten product quality or plant equipment. **End**



One of the clay settling tanks where clay clurry is permitted to thicken. Before these tanks were coated with epoxy, concrete would often be eaten to a depth of ⅜ in.

A mobile coating unit brings compressed air and power to all areas of the company's nine plants where protection is required. The paint and curing agent are mixed 1-to-1.



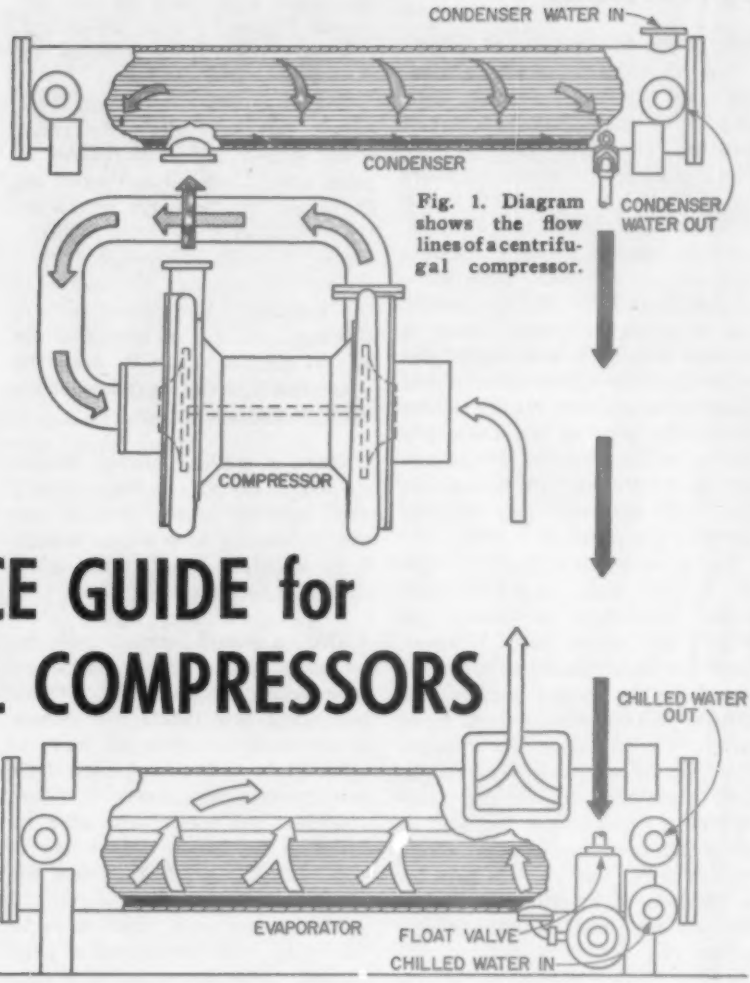


Fig. 1. Diagram shows the flow lines of a centrifugal compressor.

MAINTENANCE GUIDE for CENTRIFUGAL COMPRESSORS

By S. D. George, Chief Engineer, National Technical and Scientific Company, New York, N. Y.

THERE IS hardly a large industry today that does not use one or more centrifugals to produce chilled water or brine for process. Among the larger industries using centrifugals in great numbers are aircraft, textiles, rubber, chemicals, electrical equipment manufacture and automotive.

Since so much of our manufacturing output depends on properly functioning centrifugal compressors, their correct maintenance is of prime importance to plant engineers. Here's a simple, proven maintenance program that will help you keep this equipment in good working order.

Before setting down sure-fire maintenance tips, let's take a minute to review how centrifugal compressors work. Figure 1 is a diagram of a modern hermetically-sealed unit for industrial service.

Refrigerant vapor, evaporated from liquid refrigerant by heat transfer from warm brine or chilled water in the evaporator, is sucked into the compressor as shown. The vapor passes between the compressor blades and is whirled at high velocity, its pressure increasing slightly.

When vapor velocity is high enough, the vapor leaves the impeller at its outer edge and enters the volute-shaped casing. Here velocity is converted to pressure by the expanding shape of the volute. Vapor, at a pressure greater than that at the compressor inlet, enters condenser bottom as shown. Here cool water removes heat from vapor and it changes to a liquid.

In liquid form the refrigerant enters the float chamber where it is held until needed in the evaporator. Flow from float chamber is controlled to give just the right amount of refrigeration in the evaporator. From the evaporator the refrigerant starts its cycle over again.

Most modern centrifugal compressors use one of the Freon or Genetron refrigerants—F-11, F-12, F-114, or others. These are safe, dependable refrigerants that give little trouble. F-11, probably the most common, can dissolve rubber, grease and oil when it is in liquid form. If you remember this point you can avoid problems.

Several general rules usable with centrifugals are simple to apply and costs less than a bag of peanuts a day.

(Please turn page)

CENTRIFUGAL COMPRESSORS

Here is the list of rules to follow:

Base all maintenance on log readings. See Fig. 2. A properly kept log is more useful than a sackful of wrenches. In concise, easy-to-get-at form it gives you the number of hours the unit has run, a complete listing of water and brine temperatures, machine vacuum, speeds, bearing temperatures, and many other facts.

Careful study of the log permits you to anticipate trouble before it becomes serious. It also enables you to check on the effectiveness of your maintenance program. If one trouble persistently pops up you know it is time to review what you do and how you do it. Reviews are healthy for men and machines—they uncover incorrect procedures in a hurry.

Before we tackle maintenance specifically, let's make one general reservation. Centrifugal compressor care is fairly well standardized. However, there are slight variations from one installation to another because centrifugal units are tailor-made to fit certain job conditions. So if you're ever in doubt about any recommendations made here, consult the manufacturer. Chances are he will go along with every one of them, except in rare cases. But you will have the satisfaction of knowing the builder of your equipment is 100 per cent behind you.

Once a day check refrigerant level in the sight glass. This glass is often attached directly to the cooler but on some machines you will find it on the float chamber alongside the cooler. The glass has a hairline marking the normal level. If the liquid isn't at the correct level, check the unit performance to see if it is up to standard. If it isn't, refer to the table to find the trouble, cause and cure.

Besides checking refrigerant level, inspect the compressor relief valve, if one is used, and water removal of purge unit. Little oil and water are discharged by the purge unit when the compressor is operating properly. Lastly, if possible, overspeed compressor driving unit so emergency trip functions. You cannot perform this test every day on units that run around the clock, but it should be done once a week, regardless of the load the machine carries.

Once a week lubricate oil-type couplings. Do not run longer than a week between oilings because you may be starting some serious trouble. Enter weekly and daily maintenance checks on compressor log sheet.

Once a month lubricate compressor drive motor. Some centrifugal compressors are driven by turbines but many new plants use motors. Lubricate the turbine at least as often as the motor, more often if the manufacturer recommends it. Clean condenser and cooler tubes after lubricating the motor. Use a hair or nylon brush, depending on tube material.

Many plants now clean tubes by "shooting" cloth-inserted rubber plugs through tubes by means of a compressed-air jet. These are best for soft deposits. Use chemical cleaning for hard scale. Vent the condenser and cooler during acid cleaning so the liquid can reach all parts. Keep sparks and flames away from the machine room during cleaning. Run vent lines to the atmosphere.

Once every six months lubricate the fluid-lubricant type couplings. Test all safety controls on the machine to see that they function right. Usual controls include low oil pressure cutout and cutouts for low refrigerating temperature in evaporator, low chilled-water temperature and high condensing pressure. These controls are best tested by running the machine so it produces one of the conditions listed and observing if the control stops the unit or corrects the condition.

Annually replace oil filter and clean oil strainer. Change lube oil in the compressor and in the purge system. Clean purge unit oil separator. Check operation of compressor valves. See that coupling alignment is correct. Change motor oil and brushes. Check spare parts you have on hand. If some essential parts are missing, order replacements.

The table lists troubles you may meet while running centrifugal compressors in your plant. Of course, few, if any, compressors show all these troubles during their life. But if you run centrifugals for a few years you are almost certain to have one or more of these troubles pop up. Study the chart now and be ready to cure troubles fast when they do occur.

Chilled- and condensing-water systems are auxiliaries for the compressor but without them we cannot deliver chilled water to the plant or run our refrigerating unit. Since both circuits are similar we will examine both of them at the same time.

Modern installations usually have two chilled-water and two condenser-water pumps per compressor. If motor-driven, only one pump for each service need be run except during periods of extreme overload. So one pump normally acts as a standby for the other in the event of failure.

Maintain centrifugal pumps for these services in the usual way. No special problems arise because chilled-water temperature is seldom less than 35 F and condenser-water temperature

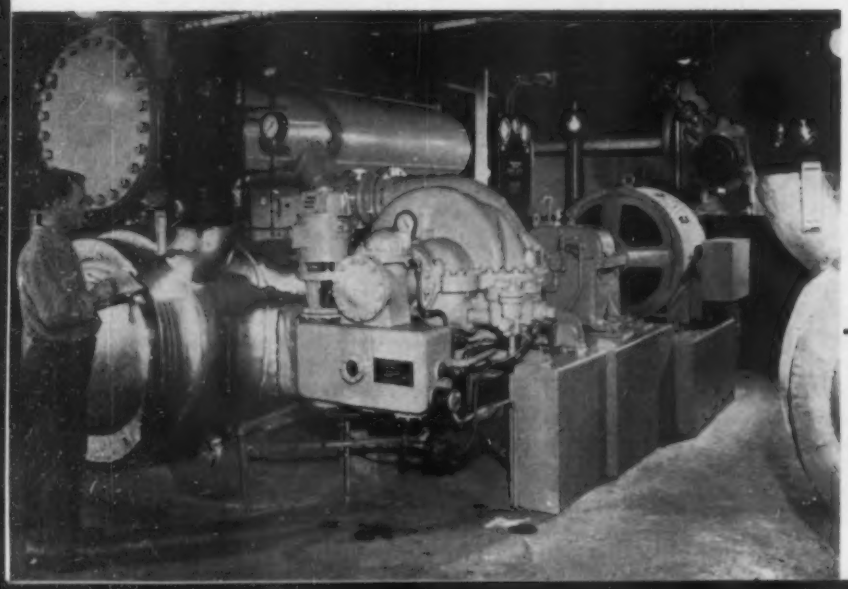


Fig. 2. Be sure to take regular log readings of the compressors. This will warn you of possible trouble.

does not often exceed 90 F. This range does not require use of special pump materials or operating practices.

Where brine is cooled by the centrifugal unit, the operating temperature of the brine pump may be well below 32 F. This pump is usually insulated and needs a little more care than a chilled-water unit.

Chilled- and condenser-water piping and valves need little care. Install pressure gages on the pump inlet and outlet connections to check pressure loss through system piping. This scheme works only when piping circuit is completely closed. With open units in the circuit—air washers or cooling towers—install a pressure gage on the pump discharge and open-unit inlet. Gradual or sudden increase in pressure loss between pump and open unit indicates an obstruction in the pipe or valve. Check to see if valves are wide open. If they are, clean interior of pipe.

Check with the air-washer and cooling-tower manufacturers for their cleaning recommendations. Clean once a year. In cold weather, check the cooling towers twice a day to be sure that ice has not formed on the intake louvers and other sections of the tower.

Most centrifugals are charged by hoisting a drum above the cooler and connecting the two with copper tubing. Use a globe valve on the drum, connecting the copper tubing to it and to the charging valve on the cooler. Use a crosswire on the cooler sight glass to determine when charging is needed.

Table outlines trouble spots, what the causes may be and how to correct them.

CENTRIFUGAL COMPRESSOR CHECK CHART

Trouble	Possible Cause	Cure
1. Low Capacity	a. Too much oil in refrigerant	a. Rectify refrigerant according to maker's instructions
	b. Condenser heat transfer low	b. Clean tubes; check condenser-water flow; check pump, piping, cooling tower; purge air from system
	c. Chilled-water temperature too high	c. Check cooler gaskets and division plate for leaks
2. High condenser pressure	a. Tubes scaled	a. Clean soft deposits with hair or nylon brush, hard deposits with chemicals
	b. Low condenser-water flow	b. Increase flow by cleaning pipes, valves, pump, and strainer
	c. Condenser air-bound	c. Purge and repair air leaks
	d. Cooling tower faulty	d. Check for clogged sprays, pump and basin; see that fan runs right
3. Low condenser pressure	a. Not enough refrigerant	a. Add refrigerant
	b. Condenser-water temperature too low	b. Reduce flow through condenser
4. Refrigerant level low	a. Refrigerant charge trapped in condenser	a. Plug leaks; add more refrigerant if needed
	b. Purge system leaks	b. Find leaks and plug
5. Surging compressor	a. Condenser pressure too high	a. See Item 2, above
	b. Not enough load	b. Open the bypass valve
6. Wrong oil pressure	a. Refrigerant in oil	a. Replace diluted oil
	b. Oil pressure-regulating valve faulty	b. Repair or replace
	c. Speed too low	c. Increase
7. Compressor oil consumption high	a. Piping leaks	a. Find and repair
	b. Worn compressor seals	b. Check for excessive bearing wear or unbalanced rotor; repair or replace
	c. Too much oil in compressor	c. Drain
8. Motor overloaded	a. Too much refrigerant	a. Check cooler gage while compressor is stopped and remove some refrigerant
	b. Too much load on compressor	b. Reduce load
	c. Open damper	c. Close to reduce load

How To Figure Water Flow

Here's a typical example of how to figure chilled-water or brine and condensing-water flow if you have two compressors. Let's assume your plant has one 400- and one 600-ton compressor. Chilled-water flow at maximum load is 2000 gpm, condenser-water flow 2500 gpm. To find the chilled-water flow rate, divide the total capacity into the total chilled-water flow, or 2000 gpm/1000 tons = 2 gpm per ton. Condenser-water flow rate is 2500 gpm/1000 tons = 2.5 gpm per ton.

Now at full load, flow through the small machine should be (400 tons) (2 gpm per ton) = 800 gpm of chilled water and (400 tons) (2.5 gpm per ton) = 1000 gpm of condenser water. For the large compressor, flows are (600 tons) (2 gpm per ton) = 1200 gpm of chilled water and (600 tons) (2.5 gpm per ton) = 1500 gpm of condenser water.

These are the quantities required for full-load operation of each machine. When load falls, so will the chilled-water and condenser-water quantities. With flowmeters in the piping from the centrifugal unit you can easily measure quantity of fluid passing and adjust the control valves.

As the load varies, have the machine operator change the output of each machine accordingly. Thus, as load increases, raise the output of both machines. As load decreases, lower the output of each machine. The method of changing machine output depends on compressor design. On some types you change compressor speed. In others the inlet damper is reset. Some machines use both types of control, depending on load.

With all compressors in the plant rated at the same tonnage, adjustments of chilled- and condenser-water flow are not necessary. Just divide the load so each machine carries the same as the others. **End**

Fig. 1. Floor-level openings in duct make it easy job to sweep chips into vacuum system for quick disposal.

Whoosh — and they're gone!

WOOD CHIPS TAKE OFF THROUGH SPIRAL PIPE VACUUM SYSTEM

AN ECONOMICAL VACUUM system in the woodworking shop of the General Electric medium transformer plant at Rome, Ga., has been collecting countless tons of sawdust and wood shavings without a hitch since its installation seven years ago.

The key to the system's economy and operating efficiency is some 2000 ft of piping which weighs one-third as much as conventional lines and costs one-half as much installed. Developed by Carrier Air Conditioning Company in conjunction with Pratt Industries, the spirally-wound conduit is called Spira-Pipe.

According to A. F. Schlotterer, manager of plant facilities, no replacements have been required despite the severe beating the pipe takes from a constant flow of hardwood chips.

General Electric uses a high grade of hardwood in the core of its transformers because it is a poor conductor of electricity and relatively light in weight. Pieces are machine-cut into required shapes. To prevent waste wood from piling up around these machines, G.E. engineers designed an elaborate vacuum system which sucks sawdust, shavings and chips directly from the cutting head of each of 30 machines into ducts which carry the waste to an accumulating bin located outside the plant.

For this application, the ductwork had to be rugged enough to withstand years of abuse from flint-hard chips with only a minimum of maintenance.

Originally, it was planned to install 16-gage, round pipe made of zinc-coated steel, then standard for such collection systems.

However, the qualities of a spiral pipe which had recently been developed were investigated. Made from a continuous strip of lightweight 24-gage metal, the pipe is joined spirally by interlocking seams. It can be fabricated in any length and in diameters ranging from three to 32 in. Obstructions inside the pipe are eliminated by the use of special fittings and joints are sealed with mastic instead of screws.

Approximately 1400 ft of this pipe, eight in. to 20 in. in diameter, were suspended by straps from the 30-ft ceiling in the woodworking shop. Smaller tubing connected the main trunks with collection hoods at each machine or group of machines. Additional drops were provided near the machines to pick up dust and shavings from the floor. These are swept into the ductwork through floor-level openings.

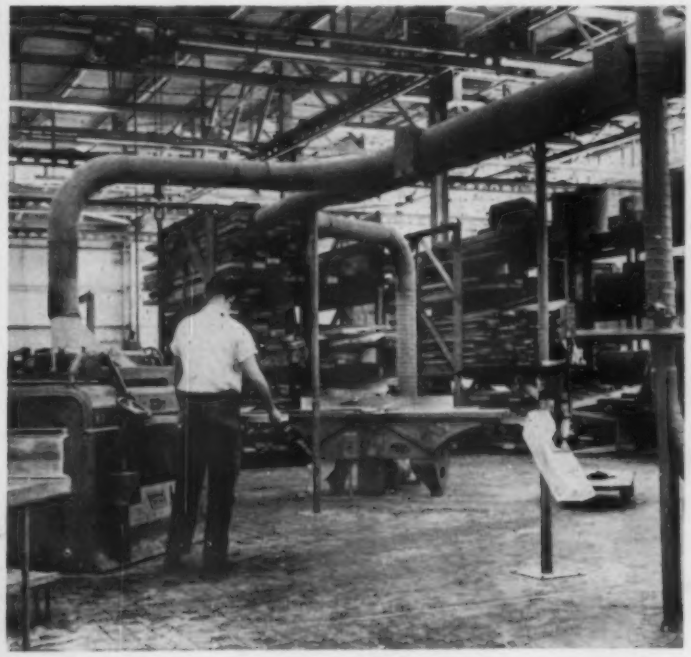
Steam lines controlled by a hand-operated valve are located inside the ducts to snuff out any fire and meet the requirements of fire underwriters.

In the main duct lines, access doors are located every 30 ft so that a clogged pipe could be readily opened. Smaller lines can be unplugged by breaking the mastic seal and taking the duct apart. In seven years of operation, the doors and seals have never been broken, nor has the steam fire extinguishing system been used. **End**

Fig. 4. Cyclone collectors dump waste in bins. Chips are removed by truck.

Fig. 3. A 20-in. pipe at ceiling carries all waste material from woodworking machines to cyclone collector outside.

Fig. 2. Group of shaping machines are served by single run of large diameter pipe. Small doors in pipe are for maintenance purposes, but they have never been used.



Fred Fryberger, AIPE president, tells group attending the regional meeting of Western chapters about the present plans and programs of the national organization and how they can best serve the local chapter.

DISNEYLAND PLAYS HOST TO WESTERN PLANT ENGINEERS

Western chapters of AIPE hold regional meeting sponsored by the Orange County Chapter

PAST, PRESENT, and future phases in the development of the plant engineer were detailed for more than 120 plant engineers and their wives at the regional conclave held at the Disneyland Hotel near Anaheim, California. An added feature of the conclave was a "behind the scenes" tour of Disneyland arranged by Truman Woodworth of Disneyland and past president of the Orange County Chapter.

Mark Levinson, president of the chapter, opened the meeting by introducing John Sneeden of the Los Angeles Chapter as master of ceremonies. Following this, Jim Weeks, past national vice president, emphasized the areas in which the AIPE might mean more to the individual and his company through earnest cooperative efforts.

Dick Morris, past president, covered "Major Milestones in a Half Century of the Plant Engineer's Development." This half century started in 1910 when Fred Gibson, a charter member of both the Boston and New York Plant Engineers Clubs, first carried the title. His career covered the formation of the first two clubs and the compilation and publishing in 1928 of the Code of the Plant Engineer. This significant milestone led Jack Morrow, the editor who published the Code, to predict the future of the national association. This prediction came true first in England, with the formation of the Institution of Plant Engineers, 1946.

Another significant milestone was the publication by Dick Morris in 1949 of a report of a meeting of the New York Plant Engineers Club where he was the guest speaker. This led to the formation of the 19 charter chapters, which banded together to form the International Association in 1955.

Closer cooperation was established with the Institution of Plant Engineers in England in 1951 when Dick Morris was invited to present a paper before the annual meeting of that Institution entitled, "The Plant Engineer in the U.S.A." This, in turn, led to the publication of the first American directory entitled, "The Roster of the Federated Plant Engineers' Clubs of America." These two activities aided the close cooperation maintained with the Economic Cooperative Administration and the Anglo-American Council on the visits of various plant engineers' teams to the U.S.A.

The first large formal meeting of members of the isolated clubs was held in Philadelphia in honor of the first British team of plant engineers to visit this country, a trip sponsored by the Institution of Plant Engineers of England. This initial meeting was followed by a meeting in Chicago in 1954 to organize the national association, which was incorporated in 1954, and formally organized with its constitution adopted in 1955.

One interesting highlight of the regional meeting was the tour of Disneyland which was arranged by Truman Woodworth, Disneyland plant engineer.

The first significant research activity of the new organization was "The Profile of the Plant Engineer" followed by a new edition of the Code of the Plant Engineer, and later by AIPE member John Lockhart's "Industrial Building Survey."

Naming of plant engineer Oscar Graveley as first Director of Maintenance of the Department of Defense further enhanced the profession. Admission of the Association to the Engineers Joint Council firmly established plant engineering as a specialized branch — recognized as such by all major engineering societies.

These pioneers, Graveley, Hamilton (a member of both Code committees), Morrow, and Morris have been honored by election to Fellows of the society. The latest Fellow, Hardgrove, was honored as a professor who first set up a four-year college course in Plant Engineering.

The next speaker, Fred Fryberger, president, covered the current activities and programs of the association from the standpoint of best serving the individual, the chapter, and the International.

Gerald Austin, president-elect, discussed the future of the AIPE. He said in part: "As surely as night follows day, the future which materializes tomorrow will reflect the objectives that we strive for today. In turn, our National objectives reflect a composite of our individual goals.

"What motivates you as an individual member to participate in this organization? I am confident that each of us has selfish considerations just as I feel safe in anticipating that two of these considerations are the desire to improve our personal professional performance and better the position of the company we represent. Quite simply, membership interest is the essential element to move our organization toward greatness." **End**

In his talk, Dick Morris discussed the growth of the plant engineer during the past half century, from the publication of the Code of the Plant Engineer to the affiliation of AIPE with the Engineers Joint Council.

View of head table at the regional meeting of Western chapters.

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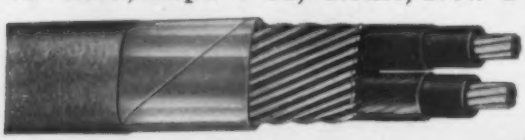

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CIRCUIT RATING IN AMPS	INSULATED CONDUCTOR SIZE AWG	LIST PRICE PER 1000 FT.	CIRCUIT RATING IN AMPS	INSULATED CONDUCTOR SIZE AWG	LIST PRICE PER 1000 FT.	DOLLARS	PERCENTAGE (Approx.)
60	6	241	60	4	235	6	2%
100	3	407	100	2	303	104	26%
125	1	784	125	1/0	472	312	40%
150	1/0	947	150	2/0	520	427	45%
200	3/0	1390	200	4/0	704	686	49%

Fig. 1. Recognizing the activities of plant engineers during their convention week, the city of Chicago declared January 23-29 "Plant Engineers Week in Chicago." Here, mayoral assistant John G. Duba, right, presents proclamation to Sig Simonson, AIPE past president and chairman of the convention committee. Looking on are AIPE treasurer-elect C. Burns, left, and AIPE president F. Fryberger second from right.

ACTIVITIES OF THE AIPE

Report on the National Convention in Chicago

AT THEIR National Convention session on January 22, in Chicago, the Board of Directors of the American Institute of Plant Engineers elected their officers for the 1961-62 term. In addition they accepted the application of a new chapter, elected a member of the organization to the position of Fellow, voted a Chapter Activity Award, and accepted donations to the AIPE student Aid Fund.

New officers, who will take office in June, are: Gerald W. Austin, Gulf Atlantic Warehouse Co., Houston, Texas, president; Joseph N. Jacques, Lakeside Laboratories, Milwaukee, Wisconsin, vice president; John E. Lockhart, General Electric Co., Cincinnati, Ohio, secretary; and Chester E. Burns, A. B. Dick, Chicago, Illinois, treasurer.

The new chapter, accepted as Number 58, was the Galveston County, Texas, Chapter. These officers will guide the group during the coming year: R. D. Blakeshire, Todd Shipyards, president; G. A. Gaberilles, Monsanto Chemical Co., vice president; C. E. Miles, Texas City Refining Co., secretary; and W. H. Shaeffer, Plymouth Oil Co., treasurer.

Fig. 2. At All Engineers Luncheon, sponsored by AIPE, president Fryberger, left, presents Thomas H. Hardgrove with Certificate of Fellowship in the Institute. This is an award in recognition of service to plant engineering.

Fig. 3. AIPE Student Aid Fund, used to help college engineering students, is formally "kicked off" with this presentation. Fund chairman Ken Banthin, left, presents scholarship check to G. I. Uitti, representing the Michigan College of Mining and Technology, for loan to students in engineering.

Other members of this newly-formed chapter are: B. Looper and G. Atkins of Wah Chang Corporation; J. L. Hebb and P. L. Tremont of Monsanto Chemical Company; H. J. Fernandez and B. L. Olson of Plymouth Oil Company; H. M. Gresham, of Texas City Terminal Railway; T. O. Powers, of Amoco Chemicals; L. Kelly, R. Harvill and K. E. Agee of Texas City Refining, Inc.; and G. W. Austin, of Gulf Atlantic Warehouse Co.

Fellowship Award

Tom H. Hardgrove, of the Orange County Chapter, was elected to Fellowship in the AIPE, in recognition of his efforts in behalf of the profession. In addition to his part in the formation of several chapters of the Institute, Tom was cited for his initiative in establishing an undergraduate course of study for plant engineers at California State Polytechnic College, San Luis Obispo, California.

Activity Award

The Chapter Activity Award for 1960-61 was awarded to the Wilmington, Delaware Chapter. This group also won the award last year.

Student Aid

Donations were received from the Cincinnati and Piedmont Chapters, in the amounts of $50.00 and $500.00, respectively, for the AIPE Student Aid Fund. **End**

Fig. 4, above. In Washington, D. C., the Education and Student Aid Committee of AIPE presented a library donation to the George Washington University Engineering library. Receiving the books for the Library is, at left, Ray Morales, vice president of the Engineers Council of the University. Presenting the books, center, is C. W. Baldwin, of the Potomac Chapter; at right is J. Ashby Williams, president, Potomac chapter.

Fig. 5, right. Overflow crowd attending the All Engineers Luncheon sponsored by the AIPE, January 24, 1961, at the Stock Yard Inn. Guest speaker was J. W. Mock of the Chicago Association of Commerce, Industry.

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building material because it's **vaporproof** it's cellular glass

FOAMGLAS overcoats protect these huge outdoor uranium separating tanks for Algom Uranium Mines, Ltd., Canada. The tough Canadian winters cannot permeate the layer of FOAMGLAS, atmospheric moisture does not affect the cellular glass composition. Even corrosive acids resulting from this processing operation can never harm inorganic FOAMGLAS.

New FOAMGLAS-BOARD wraps all the benefits of FOAMGLAS in a 2' x 4' x 1½" board that cuts installation costs. Sandwiched between sheets of special kraft laminated paper, the units reduce the number of roof insulation joints.

FOAMGLAS Stay-Dry Pipe Insulation designs the important benefits of FOAMGLAS into all building service lines—iced water, chilled water, low-pressure steam or dual temperature runs. In addition to the vapor and moisture protection, the insulation is fireproof, will not slump or sag. Permits installation of hangers around insulation.

No extra vapor seals are necessary with FOAMGLAS. It forms its own vapor barrier. That means a dependable seal against both moisture migration through the insulation and condensation within it.

Write for information on the complete line of FOAMGLAS products, and how they can work in your toughest applications. Address: Pittsburgh Corning Corporation, Dept. PE-31, One Gateway Center, Pittsburgh 22, Pa. In Canada: 3333 Cavendish Blvd., Montreal, Quebec.

PITTSBURGH

PC

CORNING

For more facts circle 575 on Reply Card

New Sinter Line Features Largest Hearth, Largest Circular Cooler

LARGEST SINTER LINE in the world, capable of producing more than 225,000 net tons (or 3000 railroad cars) per month of high quality feed for blast furnaces, is in operation at the Aliquippa, Pa., Works of Jones & Laughlin Steel Corporation.

The new installation, which towers as high as a 10-story building and spreads over almost six acres, produces a diet for the iron making blast furnaces rich enough to increase performance by as much as 20 per cent.

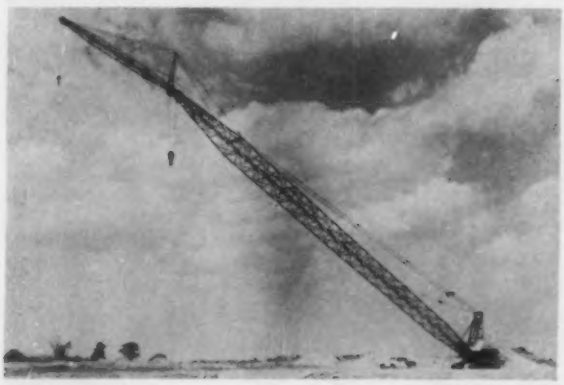
J&L's new sinter plant, which has the world's largest hearth area and the largest strand width in the U. S. of 13 ft, two in., replaces four single-strand sintering machines, installed at the Aliquippa Works in 1915.

The sintering machine, which was engineered and installed by Dravo Corporation, is a Dravo-Lurgi traveling grate type with a traveling bed of material 184 ft long. The material in the bed may be six to 16 in. deep.

In addition to having the widest and largest hearth, the J&L facility is equipped with the world's largest circular cooler, designed to bring the temperature of the sintered product down from about 1450 F surface temperature to a heat level at which the sinter can be handled by rubber belt conveyors without belt damage.

Tubular Construction of Crane Booms Permits Longer Lengths

WHEN ENGINEERS undertake the design of crawler cranes for extraordinary high work, one of the first problems they encounter is that of boom weight. That is, how to build a boom, 200 ft or more in length, light enough to be supported by a crane platform of reasonable size, but still strong enough to lift a substantial work load.



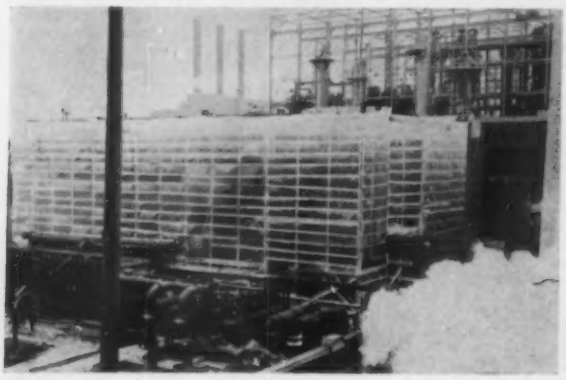
In the fabrication of extremely long members such as the crane boom, the structural characteristics of steel tubes provide an advantage in addition to their high strength-low weight property. Their relatively large cross sections provide excellent boom stability.

When the Bucyrus-Erie Company of South Milwaukee, Wis. was preparing plans for a long boom for one of their models, they decided on tubular construction. Working with the Bucyrus-Erie engineers, the Babcock & Wilcox Company recommended the use of seamless mechanical tubing of one of the high strength alloy steels as being best suited for boom construction. To withstand the anticipated stress forces, the material was tested for 70,000 psi minimum yield, 15 per cent minimum elongation in 2 in.

The first of the cranes with tubular booms contains approximately 4000 ft of job-matched tubing in its 210 ft boom, which has a radius of 170 ft, without a jib extension.

Polyethylene Film Shelters Plant Repair, Rebuilding Work

ONLY 12 DAYS after a major fire, a vital chemical operation was back in production . . . with the help of weather resistant polyethylene film, at the Gas Compressor Building of Union Carbide Chemicals Company, Whiting, Ind.



Although hampered by winter weather the cleanup and reconstruction work began immediately after the fire. An initial temporary enclosure of Visqueen polyethylene film had been erected within three days after the fire to protect the repair crews. By the time the skilled workmen—machinists, millwrights and others—were ready to do their jobs, a complete shield of tough film was set up within the old framework of the building. The interior was heated and the men were completely comfortable while going about their precision work. A translucent type of film, 6-mil in thickness, was used so that daylight could supplement artificial lighting for brighter working conditions.

While production was being maintained, a new building was being constructed over the old one. To protect construction workers and brick masons, a gigantic enclosure was erected, large enough to cover the whole structure.

Approximately 75,000 sq ft of polyethylene film, made by Visking Co., Division of Union Carbide, was used.

Corrugated Culvert Pipe, Big Enough To Run a Road Through

ERECTED NEAR Peoria, Illinois for use as an automobile underpass, a king-sized steel culvert is speeding construction of Interstate highway 74.

U. S. Steel's American Bridge Div. is installing two large pipe-arch structures, side by side, that will form a two-lane underpass through the new highway. Each unit of the twin structures will be 334 ft long. Slightly egg-shaped, the completed tunnels will be approximately 20 ft wide and 17 ft high.

Some 247 tons of five-gage copper-bearing galvanized steel plates were used to fabricate the sections. The plates, most of which measure approximately five feet by eight feet, were formed to specified shape at the fabricating plant. Units were bolted together in the field, and some 36,000 high-strength galvanized bolts were used.

A special sequence of operations was developed, to learn the most economical construction methods. Individual steel plates were bolted together to form large sections weighing as much as five tons. These sections were then moved into position at the site—all the bottom sections first, then the top sections—completing the pipe-arch.

Completed tunnels will contain 14-ft concrete roadways and pedestrian walkways, with each tunnel carrying traffic in one direction.

Piping "Fork" Delivered in One Piece

FABRICATED and erected by Midwest Piping Company of St. Louis, this 16-ton, fork-like piping assembly was delivered in one piece. It took workmen an entire day to hoist this 30-ft fabricated piping assembly into place and two weeks of welding to complete the installation.

Outside diameter of the piping is 27 in. Walls of the piping are 1¼ in. thick. The piping is being installed at Union Electric's Meramec Station Unit 4 which will have a steam output of 2,300,000 lb per hour.

Giant Fan Housing Built of Solid Plastic

THIS IS just one of two solid plastic fan housings recently built by Heil Process Equipment Corporation for a west coast manufacturer. Each of the housings measures 11 ft 3 in. long by 11 ft 3 in. high by 5 ft 4 in. wide.

Each fan is rated to handle 60,000 cfm of sulfuric acid fumes. Costly maintenance resulting from the corrosive effects of the sulfuric acid fumes is entirely eliminated because the housings, built of solid plastic glass-reinforced polyester, are unaffected by the corrosive acid fumes.

Remote-Controlled Robot Takes Flexibility, Muscle into Hazardous Areas

CALLED MOBOT II by its builders at Hughes Aircraft Co., a mobile robot has been developed as a substitute for humans, for use in areas too dangerous for man.

The Mobot Mark II system consists of six separate modules: a handling arm, power unit, control console, vehicle, multiplex command system and television viewing system. The modules can be combined into various packages to suit the application or environment.

Each arm will move 180 degrees in any direction at each of three joints; it is six feet long and can lift 25 pounds with the arm unit in any position. The wrist will rotate continuously in either direction; the hand telescopes 3½ inches.

The unit can be mounted on a wall, pole, boom or on a remote-controlled vehicle, as is the first unit. The vehicle module for this unit is three-wheeled, and is steered by the single rear wheel. It is 29 in. wide and 43 in. high. Motion of the vehicle and all movements of the arm are controlled by lever-type switches located at the operator's console.

Mobot's operator, located at the console outside any hazardous area, has complete control of all handling system functions. By manipulating control switches, he can direct Mobot in the use of auxiliary power tools such as drills, wrenches, screwdrivers, saws and torches.

CORROSION meets its match in Alcoa aluminum conduit

Here's an electrical rigid conduit that you can install and forget.

Alcoa aluminum conduit solves most corrosion problems in and around chemical plants.

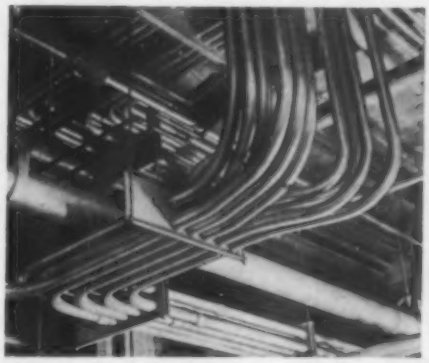
Aluminum protects itself Unlike other conduits, which require some kind of coating, aluminum forms its own protective film. This film forms naturally in the atmosphere and in the presence of oxidizing agents. Damaged spots are self-repairing—almost instantly! The natural oxide coating on aluminum takes the place of factory coatings on conventional conduits and only under unusual conditions is any other protection required.

Other advantages Corrosion resistance is just one good reason for selecting aluminum conduit. Its light weight (about ⅓ as much as steel) makes it easier to handle and install. Alcoa aluminum conduit is also nonmagnetic and nonsparking.

How about cost? Consider initial cost, savings in installation and maintenance, and service life. You'll see that Alcoa aluminum electrical rigid conduit stacks up as a sound investment.

More information For specifications, or answers to specific questions about the use of aluminum conduit in corrosive environments, contact one of our nearby representatives. Or write to Rome Cable Division of Alcoa, Dept. 5-31, Rome, New York.

ROME CABLE
DIVISION OF **ALCOA**



NO CORROSION despite moisture, chemicals and vapors in the basement of this sewage disposal plant in Cleveland. Installed in 1932, this Alcoa conduit still looks almost like new.

For more facts circle 576 on Reply Card

INDUSTRIAL PLANT CONSTRUCTION — information on location, costs

Birmingham, Ala.—Tennessee Coal & Iron division of United States Steel Corp., Fairfield, Ala., has authorized plans for the installation of new facilities for the manufacture of railroad car axles. Plans call for the installation of new heat-treating furnaces with slow cooling capacity, lathes and other machine tools for finishing the entire length of axles. Plant will also handle axles of larger sizes than those now turned out by company.

Eldorado, Ark.—Great Lakes Oil & Chemical Co. and Houston Chemical Corp., announced formation of a jointly-owned company to make bromine for the oil industry. New concern, Arkansas Chemicals, Inc., will be 50 per cent owned by each company. Construction of the $1.5-million plant is scheduled for completion late this summer. An additional $2.5 million will be spent on wells at a bromine-rich brine concentration adjacent to the plant.

Chico, Calif.—Mathews Conveyer Co. West Coast, a subsidiary of Mathews Conveyer Co., Ellwood City, Pa., will start building an $800,000 plant in the Butte County area soon. The plant will employ about 100 workers.

Hercules, Calif. — Hercules Powder Company, Inc., 917 Market St., Wilmington, Del., plans to construct a multi-million dollar methanol plant at its Hercules, Calif., facility. The new plant will provide capacity for eight-million gallons of methanol a year, 50 million lb of formaldehyde and 11,000 tons of ureaformaldehyde compositions. New plant will be the first methanol production facility on the West Coast. Product is used to make formaldehyde and as an element in plastics, coatings, drugs, solvents and anti-freeze. Plant is scheduled to go into production some time in 1962.

Tracy, Calif.—Owens-Illinois Glass Co., Ohio Building, Toledo, O., has purchased a 150-acre industrial site near here on which it has plans under consideration for the construction of a multi-million dollar glass container plant. No date for construction has been set but plant is reported to be certainty in next few years.

Tampa, Fla.—U. S. Phosphoric Products Division of Tennessee Corporation, Grant Building, Atlanta, Ga., is planning a major increase of its capacity for production of superphosphate, triple superphosphate, phosphoric acid and ammonium phosphate at company's local plant here. Production will be stepped up to an overall capacity of about 50 per cent. This expansion will cost several millions of dollars when completed in 1962. Company also has under construction at the Tampa site, an $11-million ammonia plant which is scheduled for completion in 1962.

Macon, Ga.—Armstrong Cork Co., 1010 Concord St., Lancaster, Pa., plans to construct a large new addition to company's facilities here for the production of a new type of hardwood siding for the construction trade. The new product will be made of willow and cottonwood hardwoods and will be an addition to company's line of building products. Work on the addition is scheduled to be completed by the third quarter of this year. New addition will have a floor area of 60,000 sq ft and will cost about $750,000 when completed.

Kankakee, Ill.—Armour & Co., Chicago, Ill., has authorized plans and will begin construction on an edible oil refinery plant on company property located here, about one-half mile south of the company's pharmaceutical plant. Plant will specialize in production of specification shortenings for large commercial bakeries as well as for general consumer use. New equipment in the plant will permit more precise quality control, greater flexibility in turning out specification shortenings and greater economy of operation. The new plant to be built at a cost of $6.5 million, is scheduled for completion in 1962.

Fortier, La.—American Cyanamid Company, Philadelphia, Pa., has announced that the company has purchased from Imperial Chemical Industries, Ltd., a license to make methyl methacrylate plastic used in auto parts, signs, tabletops and instrument panels. Company plans to construct a plant here—to make plastic—which will cost in excess of $1 million when completed in 1962. Plant will have a capacity to turn out between 30 and 35 million lb of plastic a year.

Reserve, La.—National Sugar Refining Co., 100 Wall St., New York, N. Y., has authorized plans that call for the modernization of company's sugar refinery located here. Work will be part of a $4-million improvement and modernization program to update several of the firm's sugar plants. Program to be completed by the first quarter of 1962 will include installation of automatic equipment and streamlining facilities.

Gloucester, Mass. — O'Donnell-Usen Fisheries of Boston and Gloucester plans to construct a million-dollar fish processing plant off East Main Street. Contract has been signed with Quincy Market Cold Storage & Warehouse Co. to build the three-story plant next to the firm's 16-million-lb freezer building, now under construction.

Jackson, Miss.—Universal Manufacturing Corporation, Paterson, N. J., has purchased a 200-acre site for the erection of a plant for the manufacture of electrical component parts. Plant will be located midway between Mendenhall and Magee on Highway 49 in Simpson County. Initial production is expected to be underway within 12 months.

St. Louis, Mo.—Anheuser-Busch, Inc., 721 Pestalozzi St., this city, has announced plans for a major expansion of productive capacity at company's brewery located here. Plans call for an increase in production of about 20 per cent. Program when completed will represent a capital outlay of $20 million. Completion of the expansion is scheduled for the summer of 1962. Brewery additions will include stock house, lager and fermenting cellars, improvements in brew house, canning and bottling departments, loading docks and truck loading, shipping additions.

New York, N. Y.—Shell Oil Company, 50 West 50th St., has authorized plans for the construction of two new natural gas processing plants in southeast Texas. A new installation at North Rincon Field will process up to 35 million cu ft of raw gas per day. Planned installation at Sealy Field will process up to 16 million cu ft of raw gas daily. Both will be the first plants in the Houston area to use hot-oil heating rather than the usual steam for stripping.

Greensboro, N. C.—W. F. Fancourt Company, 516 S. Delaware Ave., Philadelphia, Pa., has announced plans for the construction of a plant near here. Plant will produce textile oils, soaps, and specialties. Structure will be a three-story brick and concrete building which will include a research and development laboratory. Manufacturing capacity of the new unit will double the company's present capacity. Cost of land, building and equipment reported to be approximately $1 million. Plant is scheduled for completion by late summer of this year.

Sanford, N. C.—The Roberts Company, subsidiary of the General Foundry and Machine Co., will construct a building to house a new and consolidated plant and administration facilities on a 54-acre site owned by the company. New plant will have a floor area of 105,000 sq ft of what ultimately will be a 360,000-sq ft building of the most modern industrial construction design. Construction work is scheduled for completion in the late spring of 1962.

Cleveland, O.—General Electric Company's Lamp Division, Nela Park, this city, has authorized plans on the construction of a 125,000-sq ft refractory metals plant. The plant is an extension of know-how which grew out of company's experience in making lamp filaments and other products out of tungsten and molybdenum. Processing equipment will include rolling mills and furnaces that can withstand high pressures and temperatures required to work with the metals. Plant with equipment will represent an investment of approximately $15 million when completed late in 1962.

Cuyahoga Falls, O.—Consolidated Foods Corp., 135 S. La Salle St., Chicago, Ill., has announced plans for the construction of a major addition to its bakery plant located here. Work will be done under

(Continued on page 218)

SAVE SPACE

WITH NEW GENERAL ELECTRIC SAFETY SWITCHES

ON
OFF
Lugs for either copper or aluminum wire (60 to 600 amp.).
Bottom-hinged and front-operated for close ganging.
Visible blades are spring-reinforced to assure full, firm contact; minimum joints in current path; silver-plated copper parts; no fiber linkages in mechanism.
Clear ON-OFF indication from over 100 feet. Ratings plainly shown on permanent metal nameplate.
HEAVY DUTY ▲
▼ LIGHT DUTY
Safety phase barriers guard against accidental contact with live parts.

General Electric's new safety switches bring you important savings in space, longer service life, maximum safety and more economical installation. And Heavy Duty (Type A) switches sell at Normal Duty (Type C) price levels. Write for Bulletin CPD-74. See your nearest G-E distributor for a demonstration.

GENERAL ELECTRIC

Circuit Protective Devices Dept., Plainville, Conn.

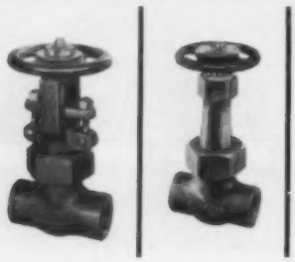
For more facts circle 577 on Reply Card

ENGINEERED TO "TAKE CARE OF ITSELF"...

New Chapman 960B Rugged-Duty Forged Steel Gate Valve

In valves, "forgetability" is a true measure of worth. "Forgetability" is defined in terms of those qualities which allow a valve, once installed, to be almost forgotten. It results from perfection of performance, and year-after-year dependability; combined with less than moderate maintenance requirements. These characteristics are the outgrowth of knowledgeable design and excellence of materials . . . both are tradition with Chapman Valves.

Product of an all-inclusive development program by Chapman, the *originators* of forged steel gate valves, the 960B represents the integrity in design, thoughtful selection of materials, and pride in workmanship which have made their name synonymous with quality valves since 1875.



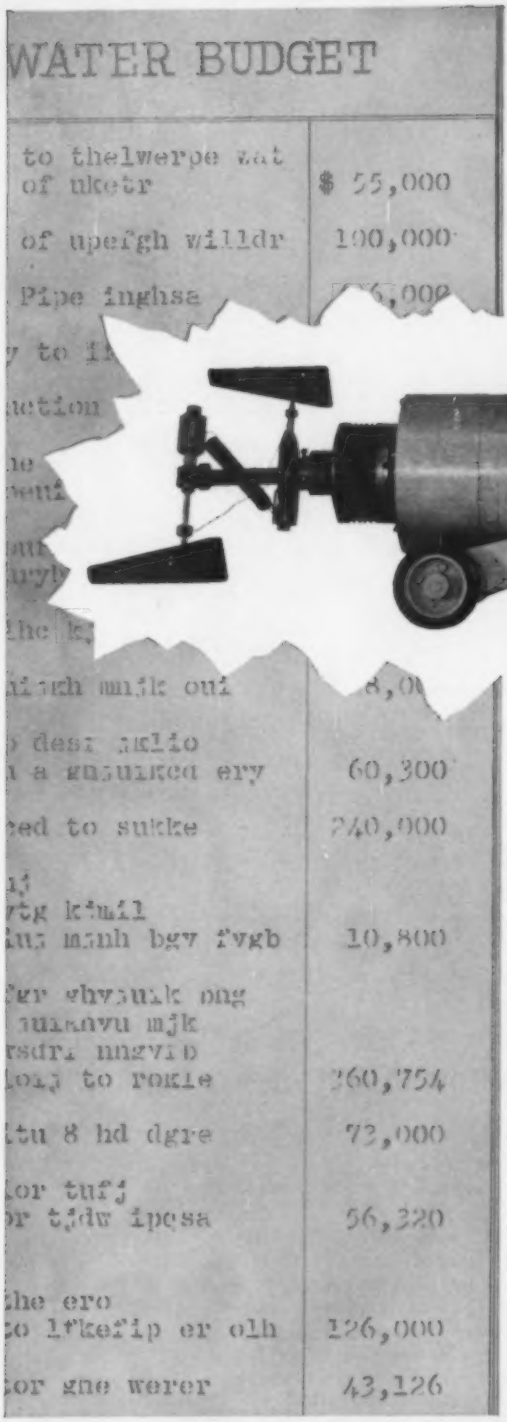
Wheel . . . cast ductile iron. **Stem** . . . heat-treated stainless steel; backseats in bonnet. **Yoke Sleeve** . . . corrosion resistant Chapman alloy CV510. **Follower and Gland** . . . socket and ball type: bind-proof follower; stainless steel gland. **Eyebolts** . . . stainless steel; swing-down design. **Yoke** . . . "bowlegged" design for exceptional hand room. **Stuffing Box** . . . bigger, with special, heavy-duty packing **Bonnet and Body** . . . forged carbon steel. **Male-Female Joint** . . . for precise alignment; makes gasket blowout impossible. **Gasket** . . . asbestos filled, spiral-wound, flexible stainless steel ribbon. **Disc-Stem Connection** . . . sliding joint prevents load transfer. **Disc** . . . hardened stainless steel; guided travel. **Seat Rings** . . . shoulder type, Stellite-faced stainless steel. **Universal Trim** . . . all standard services; temperatures to 1000°F; pressures to 2000 psi.

PRESSURES TO 2000 PSI ☐ TEMPERATURES TO 1000 F ☐ SIZES ¼ TO 2 IN. ☐ UNIVERSAL TRIM FOR ALL SERVICES

CHAPMAN VALVE

MANUFACTURING COMPANY ■ INDIAN ORCHARD, MASSACHUSETTS ■ A SUBSIDIARY OF CRANE CO.

For more facts circle 578 on Reply Card



A TOOL FOR CUTTING WATER BUDGETS

SPUNLINE® saves water

PORTLAND SAVES EVERY POSSIBLE DROP

The City of Portland, Oregon, wisely anticipating water loss before it became an important factor, recently rehabilitated its vital Bull Run pipeline.

The Spunline process will restore corroded, leaking, inefficient water lines to their original capacity and *seal every leak*. The water you pay for will be the water you use, not wasted through a leak.

The Spunline process centrifugally applies a continuous coating of dense cement mortar to the interior of the pipe. Further corrosion is prevented, flow is restored and leaks are sealed. All work is accomplished in place without interrupting normal traffic. Spunline is applied to pipe lines from 4" to 180" and may be used in cast iron, steel, wrought iron and concrete pipe lines.

Send for bulletin with detailed data and specifications.

PIPE LININGS Inc.

OUR TWENTIETH YEAR 20TH PIPE LININGS, INC.

Subsidiary of American Pipe and Construction Co.
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50 Church Street, New York 7, N.Y. • P.O. Box 1202, Fort Worth, Texas

SPUNLINE®

For more facts circle 579 on Reply Card

4311

CFC MODELS AND MEDIA TO MEET YOUR FILTRATION NEEDS

The standard line of CFC filtration equipment includes over 4311 different models and media. And if one of these isn't ideal for your application, CFC will engineer a filter to your exact needs.

CFC filters all types of industrial fluids — from Air to Zinc Cyanide — from 1 gallon per hour to 2700 gallons per minute. The complete line includes **FULFLO** Filters with media made from a wide variety of natural or synthetic fibres, resin-impregnated paper, sintered or woven metals and porous ceramics for precise filtration of liquids and gases; **HONAN-CRANE** Filters with fibre, resin-impregnated paper or adsorptive earth media for industrial oils; **DELPARK** Continuous Filters for cutting oils, coolants and other industrial liquids.

Look to CFC Filters — to improve product quality, cut maintenance and production costs, protect valuable equipment and reduce costly down time. Write for catalog or engineering assistance to Dep't PE.

CFC

COMMERCIAL FILTERS CORPORATION

Fulflo Honan-Crane Delpark Michiana

MELROSE 76, MASSACHUSETTS

PLANTS IN MELROSE, MASSACHUSETTS AND LEBANON, INDIANA

For more facts circle 580 on Reply Card

KLIKSWITCH BY GENERAL CONTROLS

Now Available through Authorized Distributors

National distribution now is available for one of the most complete lines of precision snap action switches built to industry standards. Select all your switch needs from a broad variety of precision engineered switches designed for exceptional repeat accuracy. Local authorized General Controls distributors provide prompt delivery of KLIKSWITCHES. Factory trained engineers in 44 national branch offices are always ready to give you field assistance.

TYPE S4 BASIC KLIKSWITCHES

Completely self-contained, sealed units are available from a wide selection of models with SPDT, SPST NC, and SPST NO contacts, with or without mounting ears and with a wide selection of actuators including Roller, Lever and Plunger types. S4 KLIKSWITCHES provide ideal reliable service in general purpose and heavy duty applications of all kinds.

TYPE S8 BASIC SMALL PRECISION KLIKSWITCHES

High electrical capacities are featured in this top quality postage stamp sized switch. Engineered to meet exacting requirements of small switch specifications, Type S8 KLIKSWITCHES give big performance in a small unit. Flat bases around the mounting holes afford rigid multiple mounting on common mounting screws, rods and separators for multiple cam control of several circuits.

PALM BUTTON ACTUATOR BOTTOM MOUNTING ELASTOMER SEAL
PLUNGER ACTUATOR SIDE MOUNTING ELASTOMER SEAL
ROLLER ARM SIDE MOUNTING
UNIVERSAL ROLLER PLUNGER SIDE MOUNTING

TYPE S610 ENCLOSED KLIKSWITCHES

Here are small, rugged, reliable snap action switches of tremendous life—ideal for limit, safety, control and industrial applications of all kinds. Cast aluminum housing protects switches and facilitates mounting and wiring. A wide choice of actuators and many optional features are available.

PIC G C

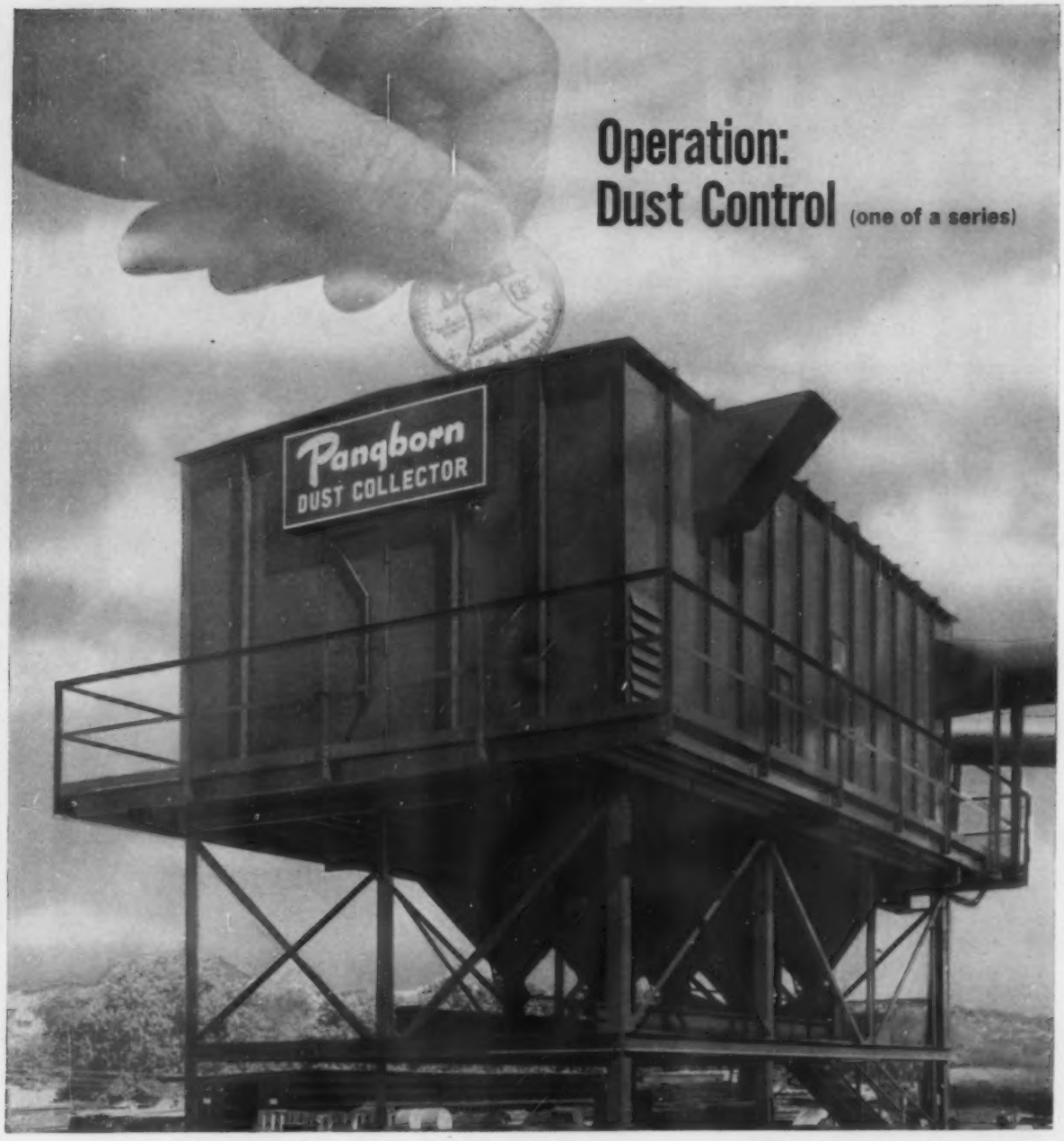
Manufacturers of Counters, Relays, Actuators and Automatic Valves

GENERAL CONTROLS *AUTOMATION CONTROLS DIVISION*

8080 McCORMICK BOULEVARD, SKOKIE, ILLINOIS • IRving 6-2323

For complete information check the yellow pages of your local directory for your nearest Authorized Distributor or General Controls Factory Branch Office.

For more facts circle 581 on Reply Card



EVER SEE A BANK LIKE THIS?

Salvaged dust can mean money in the bank. And Pangborn Dust Control equipment works quickly and efficiently to reclaim valuable dust for you.

Yet salvage opportunities are only a part of the savings offered you by Pangborn Dust Control equipment. It also eliminates health hazards in your plant and makes for better housekeeping; it removes abrasive or corrosive dusts that can endanger machinery; and it increases the efficiency of your employees and improves community relations.

Pangborn has the right Dust Control equipment for all your needs: Dry Collectors in Cloth Bag, Tube, Screen, Self-Cleaning, Unit Types and Wet Collectors in all sizes. For all the facts write:

Pangborn Corporation, 3200 Pangborn Blvd., Hagerstown, Md.; Pangborn Canada Ltd., 41 Mattson Rd., Toronto, Ontario, Canada;—Manufacturers of Dust Control, Blast Cleaning and Vibratory Finishing Equipment ... ROTOBLAST® Steel Shot and Grit™

Pangborn
OF HAGERSTOWN

For more facts circle 582 on Reply Card

Most accurate of all mechanical variable speed drives:

positive P.I.V.

Infinitely Variable

For stepless, slipless speed changing, there's nothing like Link-Belt P.I.V.—the *only* chain-driven variable speed drive.

With P.I.V., teeth—not tension—assure positive, high-efficiency power transmission. You can select any speed in its range—find it instantly, hold it indefinitely. The exclusive all-metal, self-tooth-forming chain meshes with radially grooved wheels . . . maintains positive, nonslip contact at any speed under all loads.

P.I.V. drives are fully enclosed . . . unaffected by atmospheric conditions. They're available in 8 sizes, 16 standard types, capacities from ½ to 25 hp. Type RS is available in capacities up to 50 hp.

For full details, ask your Link-Belt district sales office or authorized stock-carrying distributor for Book 2274. You'll find them in the yellow pages of your local phone directory under Power Transmission Equipment.

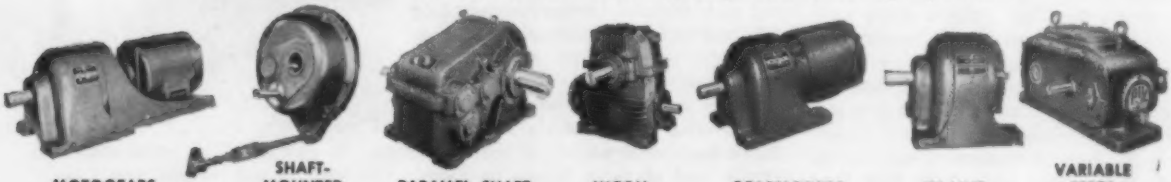
INSTANT SPEED CHANGING is achieved by simply turning handwheel to desired position on easy-to-read dial. P.I.V. drives are also available with electric, pneumatic or hydraulic controls. Here P.I.V. drive and Link-Belt roller chain accurately regulate speed of rolls in roller-hearth furnaces used to heat-treat jet engine parts.

LINK-BELT

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants, Warehouses, District Sales Offices and Stock Carrying Distributors in All Principal Cities. Export Office, New York 7; Australia, Marrickville (Sydney); Brazil, Sao Paulo; Canada, Scarboro (Toronto 13); South Africa, Springs. Representatives Throughout the World.

15,145

LINK-BELT has the right reducer for every need, every speed



MOTOGEARS | SHAFT-MOUNTED | PARALLEL SHAFT | WORM | GEARMOTORS | IN-LINE | VARIABLE SPEED

For more facts circle 583 on Reply Card

PLANT ENGINEERING EQUIPMENT.

Edited by M. E. Heniken

Reader Service Post Cards for requesting more details on products described are provided on pages 223-224.

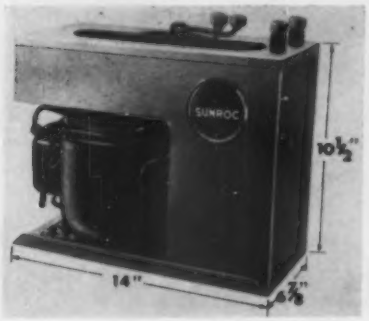
FLOOR SURFACING is wear-resistant, cement-latex type

Penntrowel Latex is introduced as an economical and hard-wearing floor surfacing for use in non-corrosive areas. Latex in the formulation contributes to ease of installation, it is noted. Only simple cleaning and wetting—no etching—of old concrete is necessary. The material can be applied in thicknesses down to 1/4 in., can be feathered out when repairing patches. Pennsalt Chemicals Corp.

▲ **For details, circle 1 on Post Card**

REMOTE COOLER packs 5 gph capacity in small space

Tiny Titan is a remote water cooling unit, only 14 by 10½ by 6⅞ in. in size—requiring about a third of the space usually taken by 5-gph capacity coolers. Manufacturer says it is ideal for supplying cold water to drinking fountains. It fits under company's own stainless steel fountains and can be connected to existing plumbing without



alterations. It is suitable for new construction, for converting existing unrefrigerated fountains to cold water fountains, and as a replacement cooler for other remote units. Because its small size permits location where convenient, the Tiny Titan is easily serviced; but maintenance is claimed to be minimized because the cooler has a water cooled condenser with non-clog gate type water valve. The unit is said to meet drinking water needs of 60 persons in normal locations. Sunroc Corp.

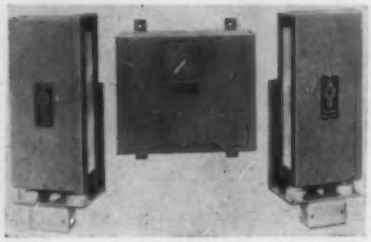
▲ **For details, circle 2 on Post Card**

PORTABLE GRINDER does precision maintenance jobs

Developers of the 37-lb GIG claim that in preliminary usage it has handled grinding, machining and boring jobs in spots not accessible with conventional equipment. It can be taken to the machine to be repaired and the work done in place—in many instances without dismantling. It is shown re-machining the seats in a 4-in. gate valve and grinding the wedge of a 12-in. one. Other applications reported include re-machining steam turbine control valve; re-machining seats in high-pressure heater tube bundles; re-machining heat exchanger head; re-machining globe, check and safety valves in the line by removing bonnet; re-machining vacuum grooves on a printing press, with 90-deg arcs diametrically opposed.

The GIG can be operated by one man. It is driven by a variable speed, high torque air motor. A smaller air motor, operating on adjustable eccentrics, rotates grinder spindle assembly in circles offset up to 1½ in. diam with reference to center line of grinder, eliminating necessity for a lathe compound for collector ring and valve grinding etc. Gilmore Industrial Grinders, Inc.

▲ **For details, circle 3 on Post Card**



PHOTOELECTRIC UNITS for presses, other machines

Modulated-light projectors are used in the Curtain of Light line of photoelectric protective equipment, designed for direct mounting on presses, shears, brakes etc. The devices are designed to stop machine operation automatically when any part of a person's body, such as a hand, enters the danger area. Equipment consists of a wide-beam modulated-light projector, (left), a wide-beam photoelectric receiver (right) and a control unit. Projector and receiver can be mounted up to 15 ft apart. Control units operate when 2 in. or more of light curtain are obstructed. The light curtain uses a modulated light beam to eliminate effects of variations in normal ambient light and to prevent use of substitute light to "fool" curtain.

For manual operation the units may be used for protection only—it stops the press if interrupted on the downstroke. For semi-automatic operation, they may also be used as a method of increasing production with manual feed, protecting operator on the downstroke and allowing replacement of parts on the upstroke. For continuous operation, the operator is not normally required to enter the die area. Therefore, the light curtain is designed to stop the press if interrupted on the downstroke. The Clark Controller Co.

▲ **For details, circle 4 on Post Card**

PUMP keeps pumped fluid away from moving parts

Announced as the "pump that never gets wet," this operates on a principle designed to eliminate contact of moving parts with fluid being pumped. Intake and outlet are one continuous flexible tube which passes through the pump body where it is exposed to the squeegee action of ball-bearing rollers. By selecting tubing material suitable to liquid handled, a variety of corrosive, sterile, and abrasive liquids or gases

can be pumped. The pump comes in two sizes, 54 and 185 gph, and is avail-

Truscon Specialists Can Help You Save Your Plant, Your Profit, Your Business!

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And this service, even though without obligation to you, is backed by over 50 years of successful experience. Truscon has, in fact, saved millions of dollars annually for plants all over America . . . through scientific protection of floors, walls, roofs, machinery and equipment.

Put this cost-cutting service to work in your plant *now*. Crack down on corrosion, deterioration and disintegration. Call the Truscon man!

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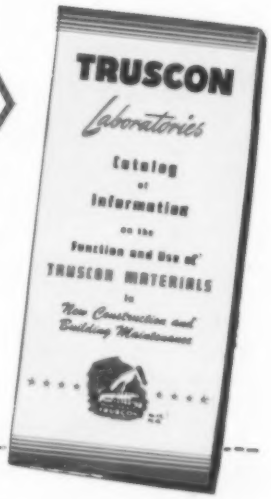


TRUSCON LABORATORIES,
1740 Caniff, Detroit 11, Michigan

☐ Send Truscon Catalog of Information ☐ Send the Truscon man.

Name _____ Title _____

Firm _____

Address _____

City _____ Zone _____ State _____

TRUSCON Laboratories

DIVISION OF DEVOE & RAYNOLDS COMPANY, INC.

For more facts circle 584 on Reply Card

PLANT ENGINEERING EQUIPMENT

(Begins on page 164)

able with or without motor, also with speed controls and explosion-proof fittings for use in hazardous areas. Prices start around $70.00 The Randolph Co.
▲ For details, circle 5 on Post Card

PORTABLE BELT CONVEYOR needs no lubrication

Model A Handy Boy utilizes a sealed bearing device claimed to eliminate need for periodic lubrication and seal out dirt and moisture as well. The conveyor has a 10-in. belt on a 12-in. bed having aluminum with steel ends and welded steel frame. Eight sizes range from 6 to 20 ft in length. Belt travels at 65 fpm in either direction. Hytrol Conveyor Co.
▲ For details, circle 6 on Post Card

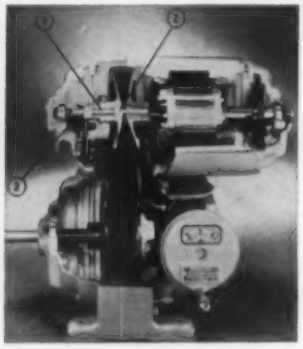
SPRAY GUN applies heavy thickness floor coatings

This gun is designed to apply a smooth, even coat of catalyzed coatings mixed with fillers such as silica and aluminum oxide. Coatings can be sprayed as thin as 1/16 in. or up to any desired thickness in one coat. The gun has

a 10-gal holding tank. Mixed material, under air pressure, passes through a 2-in. flexible hose to a spray nozzle. Regulated atomizing air forces the material into a round spray pattern. The tank rides on ball bearing wheels for easy movement during spraying. Three major advantages over troweling are reported: better control of thickness, faster application, and lower application cost. In the photo, the man at the left, operating the spray gun, is completing his job several times faster than the man with the trowel. Carboline Co.
▲ For details, circle 7 on Post Card

VARIABLE SPEED DRIVE has "built in" lubrication

The Lube-Free is a variable speed drive in which all bearings, sealed and shielded, are factory-lubricated and require no lubrication. Shaft surfaces (3) are impregnated with a tough and



wear-resistant material which eliminates need for lubrication, manufacturer states, and the keys (1) and non-metallic bushings (2) are fabricated from equally-wear-resistant material. To eliminate fret corrosion, the load is carried by non-metallic surfaces. Since lubrication maintenance is not required, the drive can be installed in any location. It is available in ¼ to 25 hp, output speeds from 4660 to 0.4 rpm, speed variations up to 10:1. Drip-proof, totally enclosed fan-cooled and explosion-proof models are available. Sterling Electric Motors, Inc.
▲ For details, circle 8 on Post Card

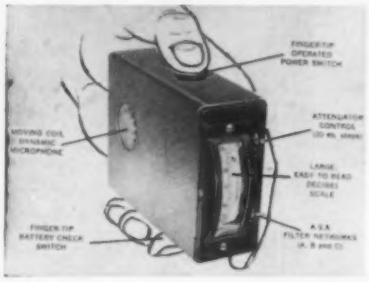
TWO-WAY RADIO is low priced, light and compact

Smallest of company's two-way communication units, the Pacer is only 4¼ in. high, 7¾ in. wide and 12½ in. long. Of aluminum construction, it weighs only 10 lb, including microphone and built-in speaker. It may be used for in-plant vehicles or in cars and trucks traveling between plants. Now in production are 15-w models to sell for around $425. The equipment uses vacuum tubes and simplified circuits in a design achieving lower battery drain than previously attained in tubed equipment. For

operation in low band (27-50 mc) and high band (150-174 mc) the units have full-quality VHF-FM audio. There are 15 tubes, two transistors. When the 15-w unit is "on," battery drain is only 4.2 amp. The control section contains a transistorized power supply adaptable to 12-v negative or positive ground electrical systems. General Electric Co.
▲ For details, circle 9 on Post Card

SOUND SURVEY METER has vibration pick-up

Type B Sound Meter is described as an accurate, inexpensive instrument, miniature in size and rugged and stable in performance due to transistorized circuitry. It can be used with its matched pick-up as a vibration meter. Designed especially for measuring noise levels in buildings and in field surveys, it assists in locating the source of potentially harmful sound levels and



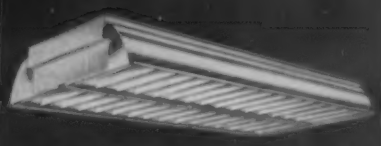
in the design of quieter electromechanical equipment. It indicates sound pressure levels from 40 to 125 db on its large scale, has a frequency response with ASA specified tolerances in the 45 to 8000 cps spectrum.

Designed for one-hand operation, Type B is only 5 in. long, weighs 1 lb (with battery) and features click-action, finger-tip controls for both attenuator and ASA filter network selectors. It is powered by a mercury battery good for 10,000 measurements, comes in a leather carrying case. A feature is ability to measure relative magnitudes of vibration of structure-borne noise by means of a mating transducer which plugs into the meter —of particular value in checking on progressive wear of machinery parts. The Korfund Co., Inc.
▲ For details, circle 10 on Post Card

PORTABLE DEVICE sharpens drills in seconds

Port-A-Point Drill Grinder chucks onto any small portable electric drill. Equipped with a steel or optional carbide grinding wheel with flip-flop drill holding device, this grinder is manually held while atached to the electric drill from which its power is received. Com-

Lighting BY miller



ALUMINUM TROFFER FOR POWER GROOVE

General Office Area, Public Service Company of Indiana, Connersville, lighted with Miller Aluminum troffers for Power Groove—125 footcandles maintained. Architect and General Contractor, Huber, Hunt and Nichols, Indianapolis.

LIGHTING BY miller SINCE 1844

Miller POWER GROOVE Lighting for Renovation and New Building Projects . . . this office is typical of many where Miller Aluminum troffers teamed with Power Groove Lamps are providing *comfortable*, high footcandle lighting at *lower cost* than ever before possible.

Designed especially for Power Groove, these Aluminum troffers are among a group of important fixtures recently introduced by Miller. Shown below are some other recent additions. For example, the Richmond for Power Groove . . . particularly suitable for lighting stores and public buildings.

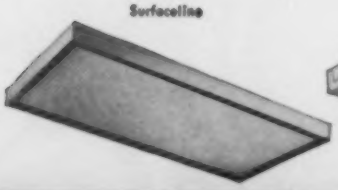
Whatever the interior—Office, Store, School, Factory or Public Building—there's a Miller fixture to meet your needs . . . for use with the fluorescent lamp type of your choice.

For further information on Miller Power Groove Lighting, or help with a specific lighting job or fixture write Dept. 261, or contact your Miller Representative.

THE miller COMPANY, MERIDEN, CONN. • UTICA, OHIO

Versaline Troffer

Surfaceline



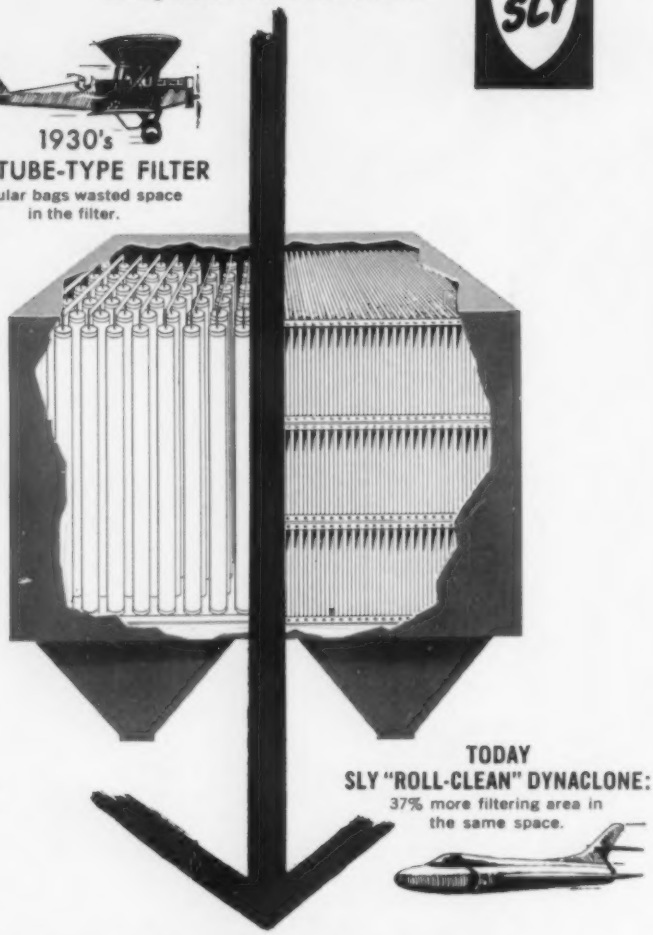
Richmond for Power Groove

Sabre

Check the Advantages of Dynaclone® Dust Filters

SINCE 1874 SLY

1930's
SLY TUBE-TYPE FILTER
Tubular bags wasted space in the filter.



TODAY
SLY "ROLL-CLEAN" DYNACLONE:
37% more filtering area in the same space.

COMPACT DESIGN MEANS 20-40% MORE FILTERING CAPACITY

Modern flat bag design is one reason why Sly outperforms other dust collectors. It provides 20 to 40% more cloth in a given space — greater filtering capacity per cubic foot of filter. The Dynaclone and other Sly Dust Filters fit in where others can't. Yet bags are more easily accessible.

The "Roll-Clean" Dynaclone also operates continuously, provides *constant* suction at dust sources for complete dust suppression.

It is automatically self-cleaning. The roller cleaner seals off bags one row at a time for cleaning by reverse air. A single exhaust fan provides suction for dust collection *and* air for cleaning. There are no auxiliary blowers.

And "Resist-O-Wear" bags give 2 to 3 times longer life on the most demanding applications.

Check *all* the Dynaclone advantages . . . *Send for 36-Page Catalog 104.*

"Roll-Clean" Dynaclone: Patents 2,867,289, 2,938,598. "Resist-O-Wear" Filter Bags: Patent 2,959,247.

THE W. W. SLY MANUFACTURING CO.

4600 Train Avenue • Cleveland 1, Ohio • Offices in Principal Cities • Overseas Licensees: Andrew Air Conditioning Ltd., London S. W. 1, England • Mideco Pty. Ltd., Nunawading, Victoria, Australia

For more facts circle 586 on Reply Card

PLANT ENGINEERING EQUIPMENT

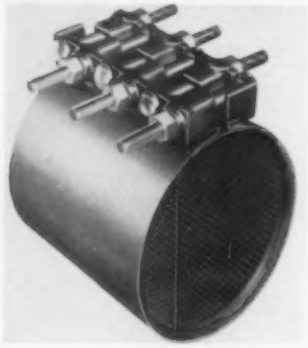
(Begins on page 164)

pany says it is lightweight and easily handled; has wide use as sharpener; points drills with accuracy; re-points masonry and steel twist drills up to ½ in. diam. Standard angle edges are ground with one clamping. Applications include punches, chisels, screwdrivers, etc. SWG Corp.

▲ For details, circle 11 on Post Card

CLAMP COUPLING has all its bolts up on top

Type 216 Full-Circle Clamp Coupling utilizes a lug design and alternating bolt arrangement designed to provide high mechanical strength, greater sealing power and lower initial cost. It fits common sizes of cast iron, asbestos-



cement and steel pipe through 8-in. nominal. The clamp assures a permanent repair and unusual ease of installation, manufacturer points out. Design advantages announced include bolt installation and tightening from most advantageous working position; nuts grouped for fast rotational tightening; no separate parts and no extra lugs. Smith-Blair, Inc.

▲ For details, circle 12 on Post Card

LOW COST FOAM insulates and soundproofs

Flo-Foam is described as a controllable, self-foaming polyurethane insulating and soundproofing material that can be sprayed or poured by the average workman. According to manufacturer, this low cost foam has a coefficient of thermal conductivity, or K factor of 0.14 at 75 F; a tensile strength of 42 psi; and a moisture vapor transmission of only 0.92 perms. Typical applications of either standard or self-extinguishing Flo-Foam include spray-on insulation and waterproofing of buildings; pipe and duct work

For more facts circle 587 on Reply Card—▶

AVAILABLE FOR IMMEDIATE DELIVERY
FROM YOUR LOCAL STEEL SERVICE CENTER

INLAND STEEL COMPANY

STEEL SERVICE CENTER INSTITUTE

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MODERNIZE–
ECONOMIZE–
STANDARDIZE–

...WITH these electrical systems by

STANDARD
TRADEMARK

TIME CONTROL SYSTEMS

PUBLICATION NO. 250

Centrally controlled, synchronized clocks, time clocks and job time recorders reduce production costs by registering time on a consistent basis throughout entire plant. Yard lights, utilities, signals programmed for automatic operation reduce personal attention required . . . eliminate human error.

FIRE ALARM SYSTEMS

PUBLICATION NO. 251

With automatic "locator" feature that permits instant identification of trouble area . . . confines fire or sprinkler damage by making possible immediate action.

ELECTRICAL TEST EQUIPMENT

PUBLICATION NO. 247

Voltage distribution panels, test stands, control consoles—custom designed by specialists—for lab or production line test use.

EMERGENCY LIGHTING

PUBLICATION NO. 243C

For protection of personnel, plant and property.
Instantaneous, automatic operation—electrically supervised, 100% dependable, with automatic recovery.

THE STANDARD ELECTRIC TIME COMPANY
89 LOGAN STREET, SPRINGFIELD, MASSACHUSETTS

For more facts circle 588 on Reply Card

PLANT ENGINEERING EQUIPMENT

(Begins on page 164)

where temperatures do not exceed 150 F refrigeration; and high strength sandwich panels. Experimental kits containing the resin and its Freon catalyst may be had at a cost under $3.00. Foam Products Mfg. Ltd.

▲ For details, circle 13 on Post Card

TWO-SPEED SAW cuts wide range of metals

Model 701 Recipro Saw, introduced for cutting all metals, has two speeds —1000 and 1400 strokes per minute— for different gages and densities. The low speed is for stainless steel, other hard alloys, cast iron, hard abrasive material. The high speed is recommended for mild steel and non-ferrous

metals. An extra heavy-duty tool, this saw is suggested for any metal cutting job requiring a portable tool for cut-off or pattern work. The saw has a foot which adjusts in and out more than 1 in. making it possible to increase blade life, and this foot has 12 depth-of-cut adjustments. Blades mount off center for cutting close to walls and corners, are also reversible for either up or down cutting. Standard equipment includes four assorted blades, blade clamp and holder, and steel carrying case. The saw costs around $125.00. An optional extra is a vise-grip foot attachment for cutting pipe, bars and round stock. Skil Corp.

▲ For details, circle 14 on Post Card

CASCADE RINSE UNIT for precision cleaning jobs

Recent addition to this manufacturer's Sonic Energy Cleaning Systems is a cascade rinse unit developed to meet precision rinsing techniques required by the semi-conductor, electro-mechanical and hydro-mechanical industries. The unit has three rinse stations. Rinse solution is pumped into the first sta-

send for bulletin no. 4

easier to maintain

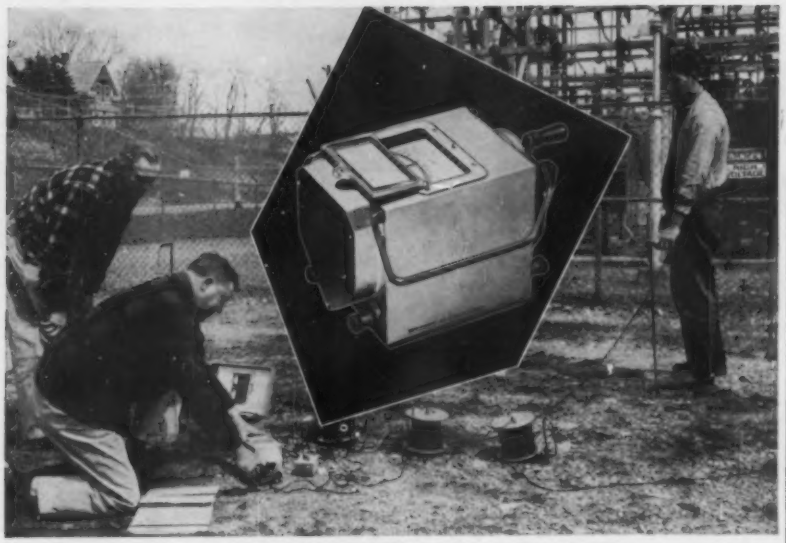
easier to install . . .

Striking new economies are now available for commercial, industrial and institutional buildings with P-K's SCALEFREE 230, the first indirect gas fired storage water heater • **Installation.** A complete and automatic package, P-K's SCALEFREE 230 can be skidded into place, hooked up and checked out quickly. There is no complicated piping or electrical work to run up costs. No stack is needed for extra draft. No foundation is necessary. Factory insulation (optional, as illustrated) further reduces costs and avoids the complications of on-the-site insulating. • **Maintenance.** P-K'S SCALEFREE 230 offers new freedom from trouble. It won't scale—and retains its rated efficiency—because heat transfer occurs below the temperature at which scaling minerals precipitate. Linings of Pre-Krete® or copper keep the storage section free of rust and corrosion regardless of water conditions. • P-K's SCALEFREE 230 is available in storage capacities from 250 to 4,000 gallons; recovery sections from 390,000 to 2,215,000 BTU. Bulletin No. 4 gives complete engineering and performance data.

Address your request to: The Patterson Kelley Co., Inc., 93 Morgan Avenue, East Stroudsburg, Pennsylvania.

Patterson Kelley
Water Heater Division

For more facts circle 589 on Reply Card



UTILITY PREVENTS ELECTROLYTIC CORROSION—RELIES ON MEGGER® GROUND TESTER

Worcester County Electric Company's underground cable system in central Massachusetts was the target of severe corrosion caused by low ground resistance to stray electrical currents, until laboratory tests revealed the situation.

After acting quickly to repair the corroded sections, the utility embarked immediately on a preventive maintenance program to stop further deterioration. The program was built around continuing tests with a Megger Ground Tester, selected because of the speed, ease and accuracy it provides in obtaining readings.

After a year's use, Worcester Electric finds that the Megger Ground Tester gives these advantages:

1 *It functions at all times*
2 *It does not have to be balanced*
3 *It does not require a power supply*
4 *It requires a minimum of maintenance*
5 *It takes rapid, accurate readings*

Savings attributed to the Megger Ground Tester preventive maintenance plan run into thousands of dollars per year. Worcester Electric is now able to spot areas of low resistance in their cables sufficiently in advance of actual breakdowns so that complete counteracting measures can be taken.

DO YOU HAVE THIS INFORMATION FILE ON GROUNDING?

The James G. Biddle Co. File 25 is an excellent fund of information on grounding problems. It includes a manual on Ground Resistance Testing, and bulletins on "Grounding Electrical Circuits Effectively" and "Grounding Principles and Practices Applied to Industrial Plants." B1010

Write Now for Your Copy of Ground Testing File 25PL.

BIDDLE INSTRUMENTS

JAMES G. BIDDLE CO.

Electrical & Speed Measuring Instruments

1316 ARCH STREET • PHILADELPHIA 7, PA.

For more facts circle 590 on Reply Card

PLANT ENGINEERING EQUIPMENT

(Begins on page 164)

tion, overflows into the second and third stations where it is drained for subsequent rejuvenation and recirculation. Parts being rinsed are submerged in the third chamber, followed by submersion in the second, and subsequently in the first—and cleanest—chamber. After rinsing, parts are normally dried in a forced air dryer. Rinse cabinet is 18-gage mild steel with tanks and top of stainless steel. Two chamber sizes are available: 14-by-20 in., and 18-by-25 in. Pioneer-Central Div., The Bendix Corp.

For details, circle 15 on Post Card

More information on any of this equipment can be yours without cost or obligation. Just circle the item numbers on the Reader Service Cards provided on pages 223-224.

ISOLATION PAD uses high density fiber glass

Kinetic Isolation Pads are designed to isolate vibration and eliminate lagging machinery to floor—without cementing, sawing, or floor drilling. They are furnished in 18-by-18-by-½ in. sheets,

pre-scored at 2-in. intervals for cutting-to-size on job-site with a penknife. Savings in installation and relocation of machinery is claimed, in addition to isolation efficiency of glass fibers and high internal damping. Consolidated Kinetics Corp.

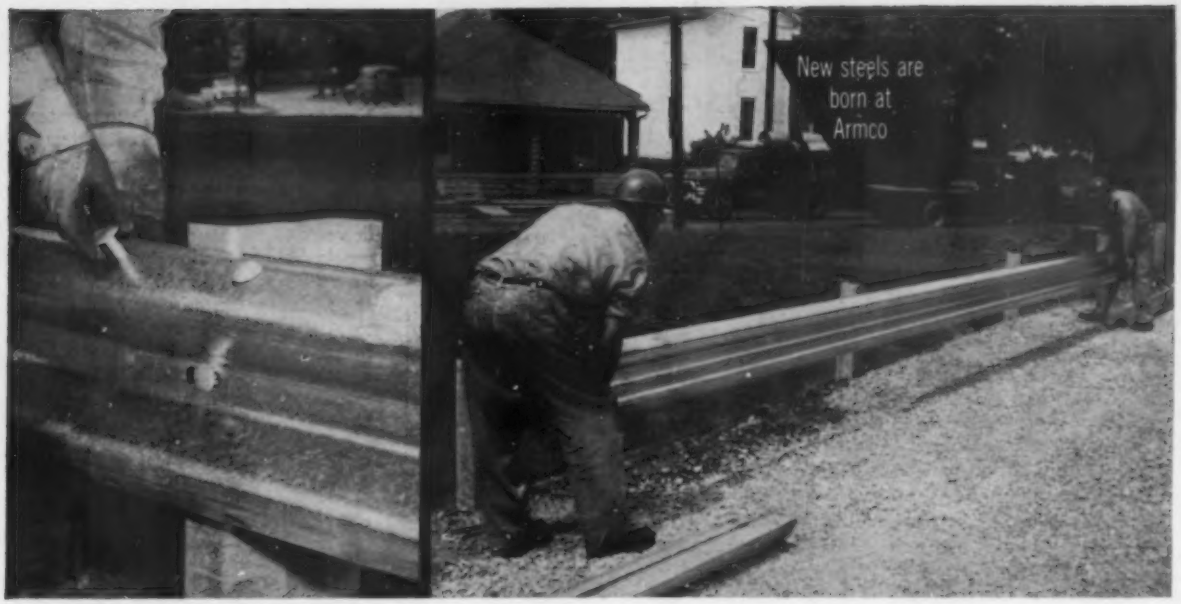
For details, circle 16 on Post Card

SWITCH actuates on pre-set flow rate

FS-925 Flow Switch is described as sensitive and dependable for detecting flow or lack of flow in small piping and tubing systems. It is a low cost, low capacity unit that actuates on a preset flow rate. It may be used to operate a remotely located indicator,

for strength, economy, durability

New **ECONO-BEAM** Guardrail



Four splice bolts and one post bolt are only fasteners required to connect sections and hold to post.

Workmen install a 25-foot length of ECONO-BEAM Guardrail in an industrial parking lot. It is strong, yet light in weight.

Saves Money Without Sacrificing Safety

For more than 25 years, Armco has supplied deep-beam steel guardrail to help safeguard the nation's highways. But heavy guardrail designed for highway speeds is unnecessary in industrial parking lots, or inside plants.

So Armco has introduced 16-gage ECONO-BEAM® Guardrail, especially designed for industrial applications. It weighs 43% less than standard guardrail, requires only 4 splice bolts as compared with 8 for highway guardrail —so is substantially lower in cost.

This guardrail is supplied with a zinc coating in 12½ or 25-foot lengths. It may be installed with wood, steel or concrete posts. Also available in curved lengths.

Write us for more data on this new industrial guardrail. Armco Drainage & Metal Products, Inc., 4991 Curtis Street, Middletown, Ohio.

ARMCO Drainage & Metal Products

For more facts circle 591 on Reply Card

"What have you done about this DUST?"

In our plant trouble is spelled D-U-S-T. And our plastics production V.P. wanted to know what I had done to get rid of it. He was mad, and frankly, I didn't blame him. Dust was costing us a lot of money each year—in machine wear, misalignment and down time—to say nothing about absenteeism and poor morale among the workers. How could the plant help but be dusty—with grinders, lathes, milling and molding machines running 16 hours a day.

But I explained that I had checked on several dust control systems. The problem was that in 6 months we planned to expand and re-model the shop. It seemed like throwing good money after bad to invest in a control system now. But the V.P. wanted action. He told me about a Torit engineer who had called on him claiming he had a dust control system that offered complete *flexibility.* Then he gave me his card and suggested I call him immediately.

Believe me, I called that Torit man, but fast. He explained to me the flexibility his system offered—how with just minor changes it could be adapted to the new plant layout. I bought one of his Torit Model 24 Cyclone machines for less than $1,000. It services 2 molding machines, a double-end grinder, 2 lathes and a milling machine. And it really performs—has practically eliminated the dust in our shop. We're finishing our expansion and I have ordered another Torit Dust Collector to service our additional machines. You'd hardly recognize our shop now. It's clean. Production is up—morale is up—absenteeism is lower than ever.

Cyclone Model 24

Torit can solve your dust problems. For complete facts on dust . . . and how to control it . . . write

TORIT manufacturing company

1133 Rankin St., St. Paul 16, Minn., Dept. 1832

For more facts circle 592 on Reply Card

PLANT ENGINEERING EQUIPMENT

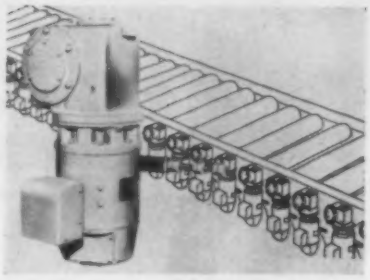
(Begins on page 164)

visual or audio; or through automatic interlock, control pump motors through suitable relays. Installation is simple. The ¼-in. NPT ports permit use of standard piping, or can be adapted to tubing requirements. The Gems Co., Inc.

▲ For details, circle 17 on Post Card

FLOATING GEARMOTORS for runout table, conveyor use

Verti-Seal Gearmotors incorporate a seal designed to prevent lubricating oil in the gear casing from leaking into windings of the integral motor mounted below the gear unit. The drives feature single reduction worm gearing with a hollow low-speed shaft fitting over and keyed to the driven shaft. A bracket, on gear case or motor, is used to connect a spring-loaded torque arm to the table to oppose the reaction torque. This allows the gearmotor freedom to float on the driven

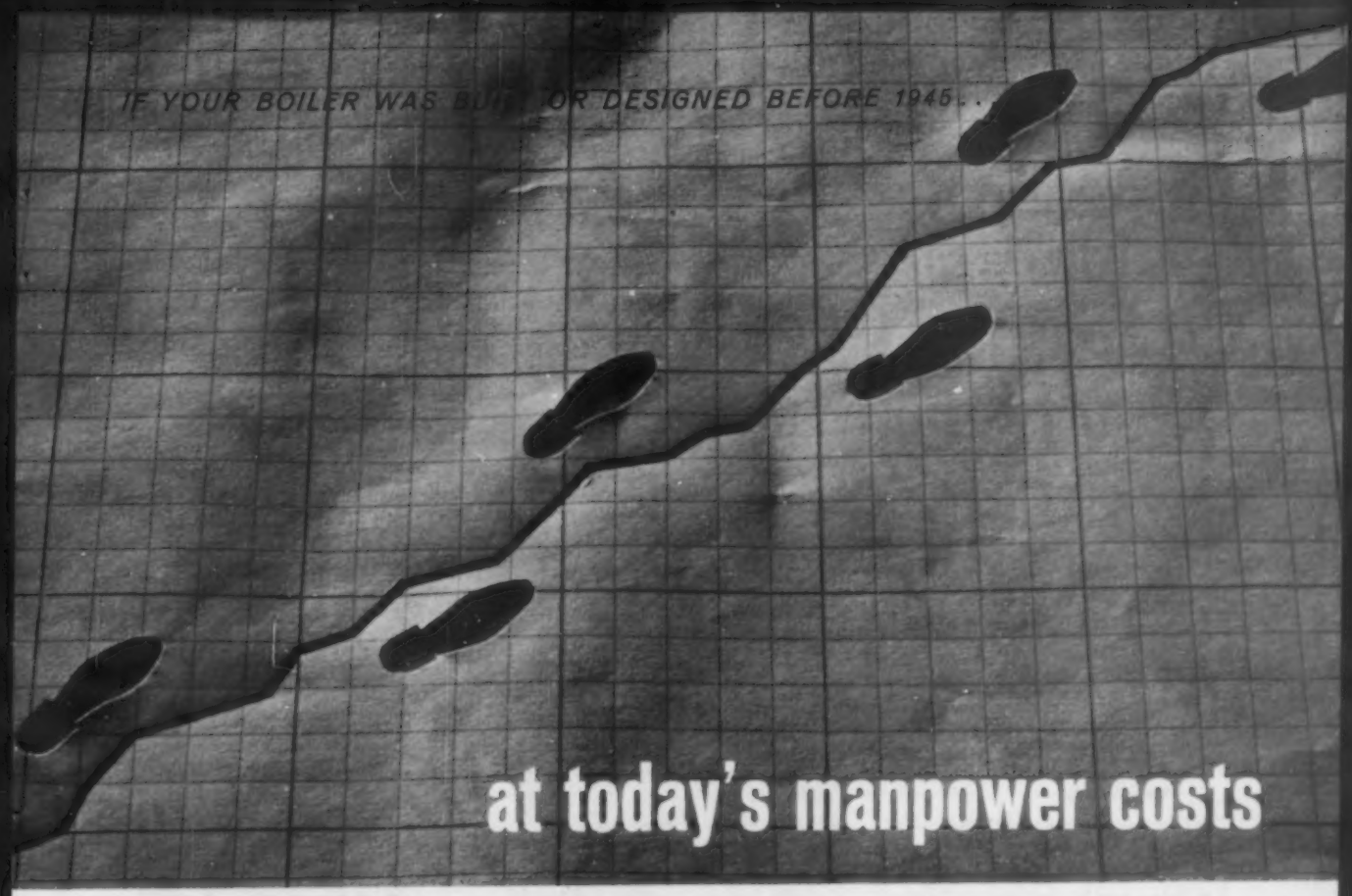


shaft, minimizing possible roll neck eccentricity, and also reduces shock caused by intermittent loadings. A further advantage noted is that these drives save up to 60 per cent in aisle space over many gearmotors, because the hollow low-speed shaft lets the unit be mounted directly on the driven shaft. Westinghouse Electric Corp.

▲ For details, circle 18 on Post Card

HIGH-PRESSURE FITTINGS have rust-proof finish

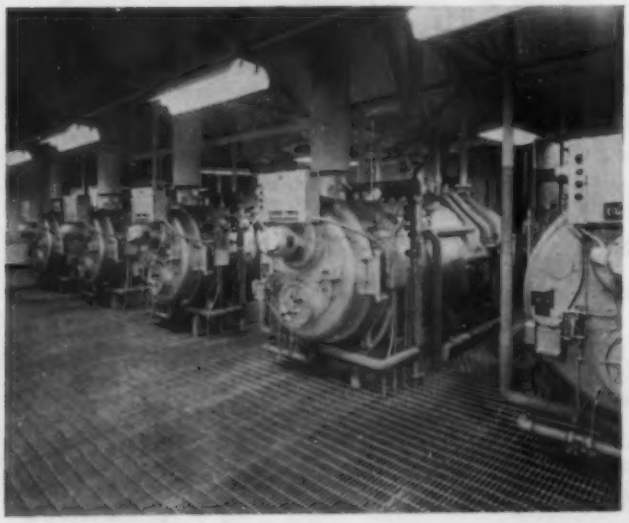
The Parkerized finish on these high-pressure pipe fittings imparts a phosphate coating to steel, protecting exterior and interior against rust scale, even when fittings are stored or used under humid conditions, according to manufacturer. Line includes forged steel screw and socket welding fittings to meet 2000,-3000,-4000- and 6000-lb pressure specifications. Included are 45-and 90-deg elbows, tees, cross and lateral fittings, cou-



you may be paying for it a second time!

$15,000-A-YEAR LABOR SAVINGS

Diebold, Inc., Canton, Ohio, century-old manufacturer of bank protection and office equipment, replaced old, coal-fired boilers with new, fully automatic, gas-fired CB boilers and saved $15,000 to $18,000 in annual manpower cost. *All five of these new boilers are operated by just one man* — other personnel have been transferred to more productive work assignments. Bill Roby, assistant plant engineer, speaks highly of the ease of installation and the compact design.



New or old, there's one thing about any boiler that's up-to-date: you have to pay today's wages for the men who tend it. This becomes out-of-line overhead if you're operating a boiler designed in the days when man-hours were far less costly.

As wages have doubled during the past two decades, one manufacturer, Cleaver-Brooks, has pioneered in making a boiler that requires fewer man-hours to operate. Today's CB packaged boilers provide a combination of labor-saving design features and performance standards that cannot be found in any other boiler — at any price.

Hinged doors, front and rear, provide for quick cleaning of the tubes. It takes only 40 seconds to remove and replace the retractable burner nozzle. Fully automatic, these boilers include electronic safety devices which release the operator for other duties. And, because some jobs require quick changeover from one fuel to another, Cleaver-Brooks boilers are designed to make this change in less than a minute.

All this is provided by Cleaver-Brooks in the most compact, fuel-saving packaged unit on the market. Sizes through 600 hp . . . oil, gas and combination oil-gas firing . . . larger sizes in Cleaver-Brooks Springfield water-tube boilers. All models completely pre-engineered and tested as a package . . . expertly started for you by a trained field engineer.

Your local Cleaver-Brooks agent can supply more details. Ask him, or write for the booklet, *How to Select a Boiler.*

Cleaver Brooks®

ORIGINATOR AND LARGEST PRODUCER OF PACKAGED BOILERS

CLEAVER-BROOKS COMPANY

Dept. C, 364 E. Keefe Ave., Milwaukee 12, Wisconsin

For more facts circle 593 on Reply Card

AUTOMATED *Hydral-60* PINCH VALVE SYSTEMS

Controlled circuitry for any operating requirements

- The Massco-Grigsby Hydral-60 System consists of one or more pinch valves with a single automatically operated hydraulic pump.
- Hydraulic pump may be operated by electric motor or by air from normal plant supply system.
- Valves may be the same or different size.
- Valves in the system may be operated simultaneously or independently.
- Control valve may be manual or solenoid.
- Valves are self-supporting and may be operated in any position from horizontal to vertical.
- Valves may be coordinated and interlocked with other plant equipment to automatically control tank levels, rate of flow, etc.
- Valves may be independently controlled for normal or rapid closure.
- Valves may be held fully open, fully closed, or at intermediate positions.
- Remote control to meet individual requirements.
- Controls may be included for automatic emergency operation.
- 3" to 14" I.D. sizes, with 50, 100, and 150 psi line pressure ratings.
- Temperatures to 200° F.

Advantages of Massco-Grigsby Pinch Valves

- Rubber, neoprene and special compounded rubber sleeves for corrosive and abrasive pulps and liquids.
- Patented "hinged" sleeve. Recesses serve as "hinges" during compression; reduce strain and permit tight closing.

- Unobstructed flow eliminates high friction loss and prevents contamination.

- Split flanges and patented Flex Seal ends assure perfect seal.
- Rugged, heavy duty construction for most severe service and long life.
- Cannot leak or stick.
- No working parts in contact with pulp or liquid; no packing glands.

WRITE FOR NEW CATALOG NO. 609

The Company that cares enough to give you the best!

MANUFACTURING DIVISION

MINE AND SMELTER SUPPLY CO.

Denver 16, 3800 Race St. | New York 17, 122 E. 42nd St. | Salt Lake City 1, 121 W. 2nd S. | El Paso, 1515 11th Ave. | Albuquerque, 701 Haines N.W.

LICENSED MANUFACTURERS AND SALES AGENTS in Canada, Australia, Sweden, England, South Africa. Sales Agents in Mexico, Peru, Chile, Philippine Islands, Japan, New York City (for Continental Europe and in principal cities of the U. S.

For more facts circle 594 on Reply Card

PLANT ENGINEERING EQUIPMENT

(Begins on page 164)

plings, reducers and caps to fit pipe ⅛ to 4 in. Clayton Mark & Co.

▲ For details, circle 19 on Post Card

CONDITIONER enables dustless handling of dry stuff

The Verticone is a bulk-material conditioner for powdery, finely-divided materials—even fly ash. With it, dust collector bins, bagging and loading operations are dust-free, manufacturer states. The unit suppresses dust by adding a controlled amount of moisture into the material, wetting all surfaces of each particle with surface-active Compound MR.

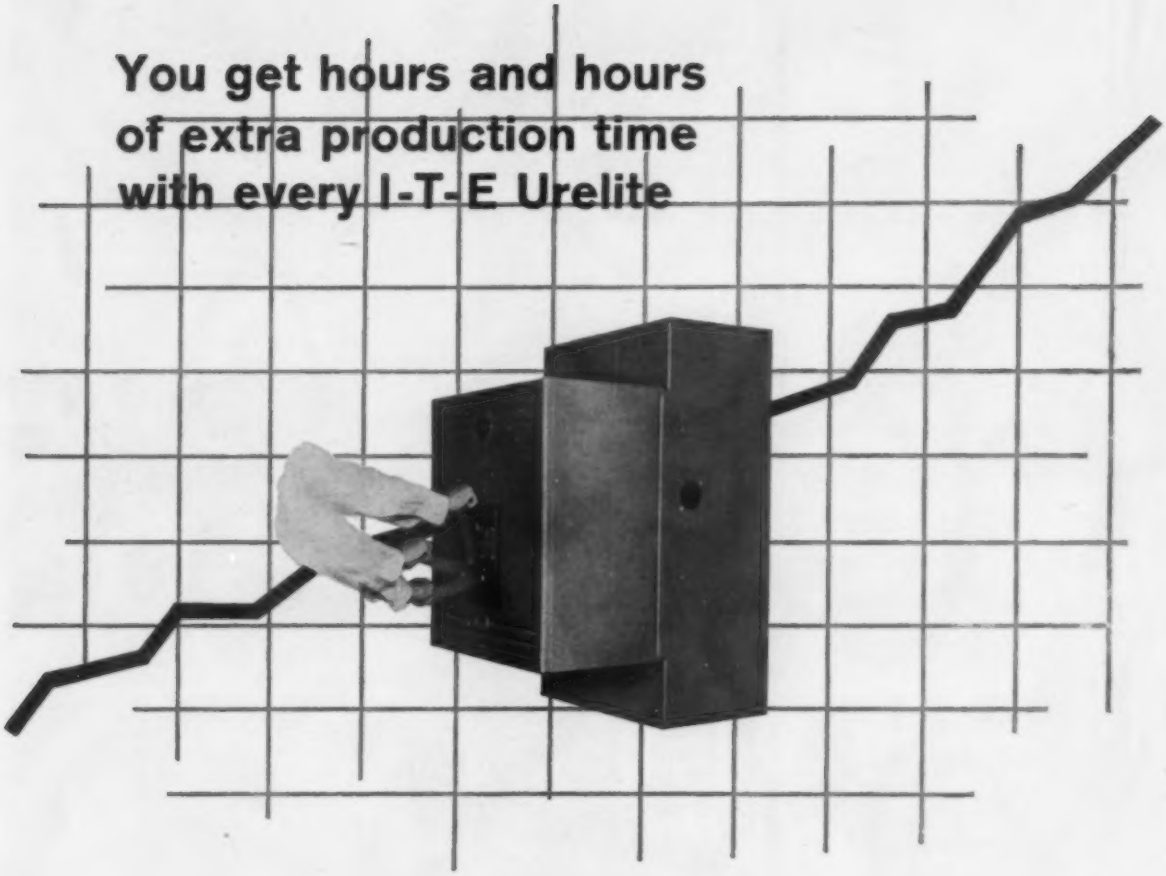
The solid stream of material is introduced into a distributing cone at the top of the unit. The material falls over this cone and leaves its base as a thin-walled hollow cylinder. A spray jet inside this cylinder of falling material applies the solution so that all surfaces of the solids are conditioned. Where incoming material temperature is above 250 F, rapid wetting is achieved by generation of steam as plain water is applied through the spray. Under these circumstances the wetting agent is not recommended. Verticones come in various capacities. In those with sanitary construction, all parts are removable. The Johnson-March Corp.

▲ For details, circle 20 on Post Card

HEAVY DUTY FLOORING takes oils, chemicals, hot water

Duratrem is reported to have exceptional resistance to solvents and chemicals—and to withstand heavy trucking. It has a non-slip, light gray finish. This topping is designed to meet tough flooring problems presented in food processing, chemical and petroleum industries and others in which manufactur-

You get hours and hours of extra production time with every I-T-E Urelite



Urelite® is the individually enclosed power circuit breaker that can be installed anywhere. If you have a power interruption, pull the Urelite handle. Presto! you have power back. No prolonged delays before you can resume production. Only the I-T-E Urelite has so many extra conveniences for easy installation, easy operation, and easy upkeep. Up to 4000 amp continuous, 150,000 amp interrupting. Big cable area facilitates installation. Drawout construction. Visible break provided through inspection windows at sides. For Bulletin 4261-2B, write I-T-E Circuit Breaker Company, Dept. SW, 1900 Hamilton St., Philadelphia 30, Pa.

I-T-E CIRCUIT BREAKER COMPANY

For more facts circle 595 on Reply Card

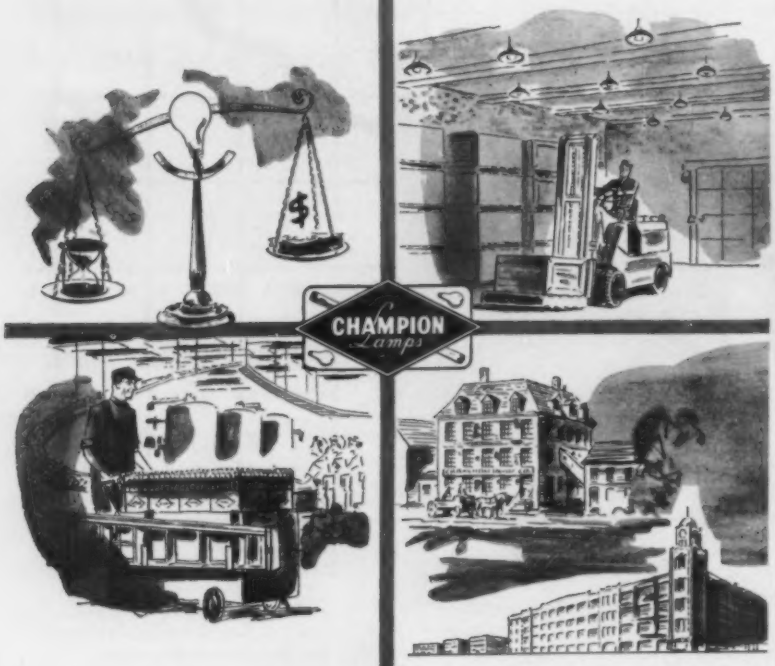
Facts of Light!

YOU CAN'T GET BOTH HIGH EFFICIENCY AND LONG LIFE IN INCANDESCENT LAMPS

General service incandescent lamps are designed so that the ratio between life and efficiency (light output) results in lowest overall lighting cost for the average installation. When efficiency is increased, lamp life is shortened. When lamp life is extended, efficiency goes down

SOME PLANT AREAS "STEAL" LIGHT

Poor reflective surfaces drastically reduce the useful light you get from a lighting system. For instance, brick walls reflect only about 13% light. Smooth walls painted white, on the other hand, reflect 80-85% light.



GROUP RELAMPING SAVES 17 MINUTES PER LAMP IN MAINTENANCE TIME

Maintenance studies show that it takes an average of 20 minutes to replace a single burned out lamp as against 3 minutes when lamps are group replaced.

SIXTY YEARS' EXPERIENCE GOES INTO CHAMPION LAMPS

Champion has been manufacturing incandescent lamps since 1900 and fluorescent lamps since their advent in 1938. Over 3,000 types and sizes are available.

Your Best Buy in Lamps

CHAMPION LAMP WORKS, Lynn, Massachusetts

CHAMPION INCANDESCENT-FLUORESCENT

For more facts circle 596 on Reply Card

PLANT ENGINEERING EQUIPMENT

(Begins on page 164)

ing conditions involve spillage of acids, alkalis, hot water, grease and oils. Duratrem is easy to apply, can be feather edged, requires no compacting and, normally, no primers. It is said to take light traffic after 12 hr, heavy traffic after 24 hr. The Tremco Mfg. Co.

▲ **For details, circle 21 on Post Card**

TAKE-UP FRAMES accept all types of bearings

Multi-Bearing Take-Up Frames, available from stock in 11 sizes, are designed to accommodate any type of bearing—babbitted, bronze, ball or roller—in any two-bolt pillow block with mounting holes up to 5/8 in. The steel frames allow horizontal bearing adjustments from 6 to 24 in., and will

mount 143 bearing shaft sizes from 5/8 to 2-7/16 in. diam. Mounting pads adjust to mounting holes in the pillow block. One pad is moved by an adjusting screw, while the other slides to proper distance between holes. This mounting flexibility lets each frame accept a wide range of pillow block bore sizes. Mounting bolts are zinc plated and washers and nuts for mounting the pillow block are furnished with frame. Leaflet 2821 gives information. Link-Belt Co.

▲ **For details, circle 22 on Post Card**

Use the Reader Service Cards provided on pages 223-224 to ask for more information on any of this equipment.

SCAFFOLDING supports 60 times its weight

Windowstep, a 9-lb tubular steel window scaffolding designed to hold up to 60 times its weight, hooks over any standard windowsill. Features include an 11-by-21 in. working platform with over 500-lb capacity; a built-in guard

Realock Fence won't last as long as the Pyramids but...

... this sturdy chain link fence will give *your* property a lifetime of reliable protection. Made from top grade steel wire, Realock Fence is strong and durable, neat and trim looking. It's recommended where security of buildings, grounds and equipment is essential.

Realock Fence is completely galvanized to assure long-lasting resistance to corrosion, and is available in a variety of types. For a free estimate at no obligation, call the nearest CF&I office.

The Colorado Fuel and Iron Corporation
Denver • Oakland • New York
Sales Offices in All Key Cities

For more facts circle 597 on Reply Card

ROYAL Portable Cords

Open a carton of Royal portable cord and you *know* you're getting the easiest handling, fastest working cord available anywhere. Flex it, crimp it, strip it . . . and you can see why Royal cord meets *all* your job requirements for flexibility, safety, and durability. Royal's reputation for quality and dependability rate Royal Cords *first* among electrical men from coast to coast. Your wholesaler has a complete range of cord types and sizes — rubber, neoprene, plastic jackets — fixture wires, lamp cords — thermo cables, coaxial cables, bell and machine tool wires, and more. They're made right, packaged right, priced right—start to use them today!

ROYAL ELECTRIC ...an associate of LTT

ROYAL ELECTRIC CORPORATION
PAWTUCKET, RHODE ISLAND
In Canada:
Royal Electric Company (Quebec) Ltd., Pointe Claire, Quebec

For more facts circle 598 on Reply Card

PLANT ENGINEERING EQUIPMENT

(Begins on page 164)

rail for safety; and rubber bumpers at contact points. Priced under $14.00. Newark Ladder & Bracket Co.

▲ For details, circle 23 on Post Card

WATER-SAVING FAUCET for single-handle service

For installations requiring single-handle, cold water service, the Easy-Push is a self-closing metering faucet claimed to practically eliminate water waste and offer savings up to 25 per cent in water use. The faucet is operated by depressing a lever-type valve

handle with fingertip pressure. A predetermined amount of water—from a dash to 1½ gal—is discharged and then the faucet shuts off automatically. If desired, the Easy-Push can be equipped with company's Vandl-Rator which introduces air bubbles into the water. Of chrome plated brass, this basin faucet may be used individually or in pairs, on new or old fixtures. The inlet has standard ½ in. OD slip connection. Speakman Co.

▲ For details, circle 24 on Post Card

AIR COMPRESSOR handles heavy duty operations

The TT6 Air Compressor is a 30-hp unit delivering 141 cfm, designed for heavy duty, three-shift service. Foot mounted on rubber (no foundation required), the two-stage, single-acting

Some Straight Talk On Steam Trap Capacity

...or pulling away the curtain of confusion that surrounds steam trap capacity ratings.

Unfortunately, for the steam trap buyer, the subject of steam trap capacity has become cloudy and confused by a landslide of claims, counterclaims and inconsistent "standards" for measurement. So let's take a cold hard look at this subject so vital to the efficient operation of your plant.

What Determines Steam Trap Capacity?

There are three factors that determine the capacity of a steam trap:

1. The area of the orifice.
2. The density of the condensate.
3. The pressure differential across the trap.

Let's take a closer look at each of these:

Area of orifice is usually specified by the trap manufacturer or can be calculated from the diameter. Nothing complicated here.

Density of condensate depends on temperature. A cubic foot of cold water weighs 62.4 lbs. At 250° F. or 15 psi, it weighs less than 59 lbs. This is important. Don't overlook it.

Pressure differential across the trap is most significant. And it is complicated by the many factors that affect it, such as:

1. Pressure drop between unit drained and the trap when the trap valve is open.

2. Distance the trap valve is moved from the valve seat.

3. Back pressure on the trap with orifice closed; i.e., return header pressure.

4. Increase in back pressure produced by condensate and flash steam flowing in the discharge line. This in turn is affected by the diameter and length of the discharge line, plus friction caused by valves and fittings.

Orifice Capacity Vs. Steam Trap Capacity

Figure 1 shows a ½" diameter sharp-edged orifice at the end of a pipe filled with cold water at 15 lbs. pressure. The capacity of this orifice, using a .61 coefficient of flow would be 8,800 lbs. per hr. Now, would this ½" orifice if used in a ¾" steam trap installed as shown in Figure 2 provide the trap with a continuous discharge capacity of 8,800 lbs. of hot condensate per hour? The answer is "no". And here are some of the reasons why:

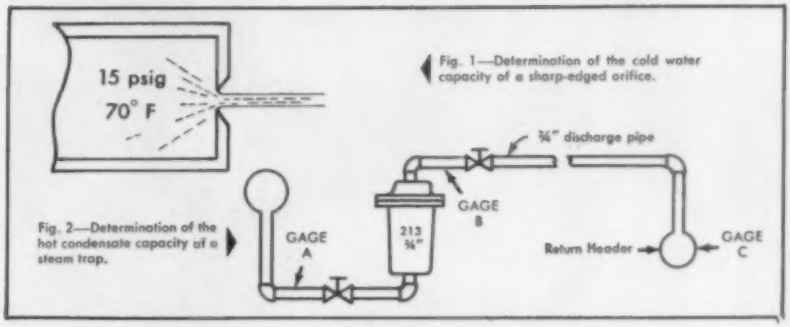


Fig. 1—Determination of the cold water capacity of a sharp-edged orifice.

Fig. 2—Determination of the hot condensate capacity of a steam trap.

Density of condensate. As pointed out above, cold water weighs 62.4 lbs. per cu. ft. At 15 lbs. pressure and 250° F. water weighs less than 59 lbs. per cu. ft. This difference in density alone reduces the lbs. per hour capacity of the orifice by over 5%.

Pressure differential across the trap. With the trap valve closed we have a static pressure differential of 15 psi. The trap valve must be able to open against this pressure. However, this is not the pressure differential that will determine the capacity of the trap valve.

The ¾" discharge line will be full of a mixture of flash steam and condensate. To keep this mixture flowing from the trap outlet to the return line requires a pressure differential. In actual capacity tests run as shown in Figure 2 Gage B at the trap outlet registered 11 lbs. back pressure. Thus the true pressure differential across the trap was about 4 lbs. Under these conditions the measured capacity of the trap was 4,340 lbs/hr. or just about half of the capacity of the ½" orifice for cold water.

How Armstrong Determines Capacity Ratings

Armstrong trap capacity ratings are based on hundreds of tests under actual operating conditions. In these tests, the condensate used was at the steam temperature corresponding to the test pressure. Thus, the capacities determined take into account the pressure drop that occurs when the trap orifice opens and the choking effect and back pressure of the flash steam. Actual installation hookups were used so that pipe friction in both inlet and discharge lines as well was reflected in the results.

Let's go back to the example cited above and in Figure 2. The trap referred to is an Armstrong No. 213. While it did test out at 4,340 lbs. per hour for a static pressure differential of 15 psi, it is rated in the catalog at only 3900 lbs. per hour for this pressure—just to be on the safe side.

For the trap buyer, this means that Armstrong Steam Trap capacities are based on handling condensate at steam temperature for the stated static steam pressure differential under actual working conditions.

Capacity ratings which don't take into account all of the variables will be misleading and may lead to the selection of undersized traps. So whenever you specify or buy traps be sure that the capacity ratings you work from are realistic. One way to be sure is to select Armstrong Traps with *guaranteed* capacity ratings.

* * *

Additional information on trap capacity ratings, plus data on how to correctly size, install and maintain steam traps for any pressure, any temperature and any load, are presented in the 48-page Armstrong Steam Trap Book. Ask your local Armstrong Representative for a copy or write:

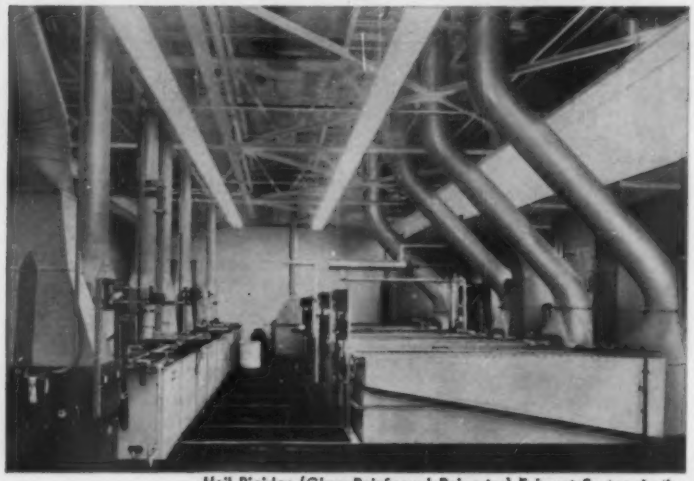
Armstrong Machine Works
9121 Maple Street
Three Rivers, Michigan

ARMSTRONG STEAM TRAPS

For more facts circle 599 on Reply Card

HEIL of Cleveland

PLASTIC VENTILATING SYSTEM at *Western Electric* plant



Heil Rigidon (Glass Reinforced Polyester) Exhaust System in the Plating Room of Western Electric Company's New Omaha Plant.

features attractive appearance, high strength, long life, easy installation and complete corrosion resistance

Western Electric Engineers wrote the specifications. The ventilating system for their plating room must look as modern and attractive as all other parts of their new plant. The system must positively resist exposure to fumes and the splash of acids and alkalies. It must be sturdy and rigid; and combine long life, low maintenance, be easy to install or re-arrange, and low in first cost. The Heil Rigidon system pictured above met all these requirements.

In your plant also, Heil service-proved plastic ventilating equipment will definitely cut the costs of handling corrosive fumes. Complete line, including collecting hoods, ducts, fans, stacks and fume scrubbers in Rigidon (reinforced plastic) or Rigivin (rigid vinyl) construction. Wide range of standard sizes speeds delivery and minimizes engineering costs.

Heil Centrifugal and Axial Rigidon Reinforced Plastic Fans.

Heil Fume Scrubber and Rigidon Duct Work.

Write today for Bulletin No. B-500. It lists chemical resistance data and specifications of standard sizes of equipment that can be installed by your own maintenance men or local contractor.

CHEMICAL-PROOF LININGS · TANKS HEATERS PLASTICS

HEIL PROCESS EQUIPMENT CORPORATION

12940 Elmwood Ave. • Cleveland 11, Ohio

For more facts circle 600 on Reply Card

PLANT ENGINEERING EQUIPMENT

(Begins on page 164)

unit offers advantages of a heavy duty machine while retaining flexibility of a portable compressor. It is designed to facilitate flow of lubricating oil and eliminate condensation. Equipped with an air-cooled intercooler, unit is rated for working pressures to 125 psi, offers output of 115 cfm at 100 psi when running at 1170 rpm, and 141 cfm at 100 psi, 1450 rpm. Atlas Copco, Inc.

▲ For details, circle 25 on Post Card

INDICATING-LIQUIDS are color-coded for accuracy

These color-coded indicating liquids for manometers and hydrostatic gages range in specific gravity from 0.824 to 13.546 at 68 F, giving wide choice of instrument sensitivity and range. Gravity of each liquid remains constant, company states. Each liquid has its own color (orange, blue, green, purple, brown, red and silver), showing meniscus in sharp outline for accurate readings. Catalog 2008 gives data. King Engineering Corp.

▲ For details, circle 26 on Post Card

PATCHING MATERIAL makes lasting chuck hole repairs

Zor-X is announced as the most permanent of patching materials for parking lots, driveways etc., making possible repairs that will outlast the original pavement. Its performance is attributed to a coalescent process which blends emulsified asphaltic oils with graded prismatic aggregates, keeping them suspended until compression is achieved. The coal tar aggregates then join in union with the emulsified oils to form bond—even in weather conditions involving water and extreme cold. Normally, asphaltic oils and liquid coal tar are incompatible, it is explained, but this process holds these elements in prolonged suspension until used. Zor-X stays fresh in the container and is ready for use without mixing or heating, manufacturer

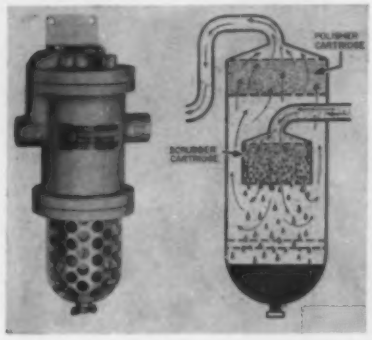
states; it's cohesive and easy spreading, can be applied on wet surfaces and in temperatures as low as 15 F. The Monroe Co., Inc.

For details, circle 27 on Post Card

COMPRESSED AIR FILTERS with coalescent action

These filters are claimed to remove practically all entrained dirt, oil and water from the air, and to normally operate for months without maintenance. For use with air operated instruments and equipment and for cleaning process air, they remove liquids by coalesence and give the air a scrub-and-polish treatment. Maximum flow rates are 20 to 200 cfm; pipe sizes, ¼ to 2 in.

Entering air flows down through a wet filter bed in a scrubber cartridge.



This removes dirt particles down to 2 microns. In addition, mist and fog particles of oil and water coalesce and combine as they pass through the wet filter bed. At the bottom of the cartridge, the liquid particles, removed from the air, are formed into large drops which fall into a sump.

The scrubber cartridge is furnished pre-saturated to start the coalescing and its operation depends on its being saturated. Thus, this cartridge is not replaced when wet with oil and water removed from the air, but keeps on filtering. Air downflow continuously clears it of excess liquids. When air leaves the scrubber cartridge, it reverses direction and passes up and out through a dry-bed polisher cartridge at the top of the filter, where last traces of liquid are removed. Catalog 6000 gives data. King Engineering Corp.

For details, circle 28 on Post Card

PIPE DOPE comes in convenient tape form

Pipe-Pac is a pipe dope in tape form for making fast, economical threaded joints in metal, plastic, ceramic, rubber and other materials. It reportedly withstands temperatures from -300 to 500 F, is suited for pipe carry-

"Tough Buyers" find what they need in the Reznor line of direct-fired heaters

The reason is simple. Reznor has more types and sizes to choose from:

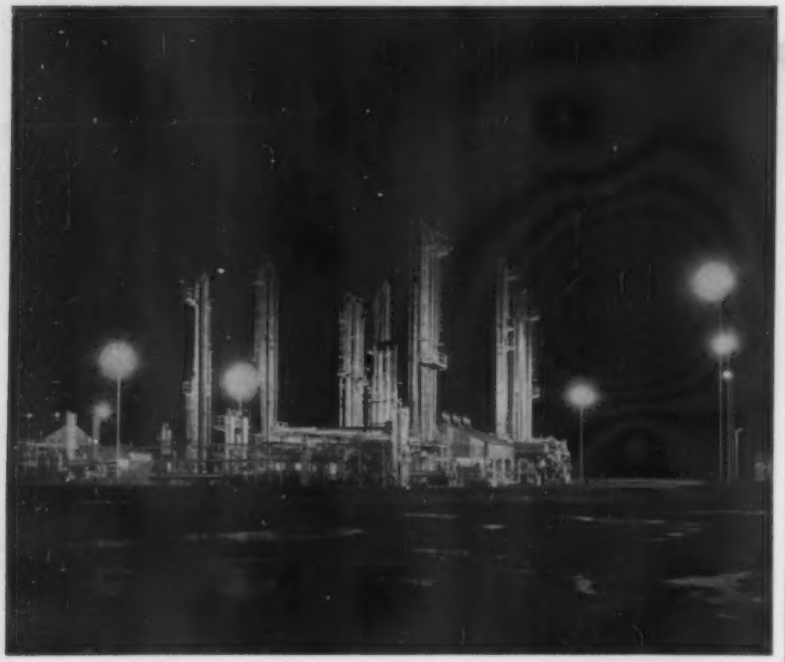
- Money-saving, space-saving unit heaters with three control options, propeller or blower fans, 25,000 to 300,000 Btu.
- Low cost, versatile duct furnaces in capacities of 50,000 to 300,000 Btu and up, for central heating, year-round air conditioning, or heating of make-up or process air.
- Matching, quiet-operating blower packages, if a separate air handler is needed.
- The new Reznor Venter, an automatic vent exhauster that lets you install Reznor unit heaters almost anywhere.
- Effective, five-way heaters for high ceiling applications, 300,000 to 600,000 Btu.

Ask your Reznor representative for a copy of Catalog SA-5900, with complete data on all Reznor heaters. Or write Dept. 91U, Reznor Manufacturing Co., Mercer, Pa.

REZNOR HEATERS

"WORLD'S LARGEST SELLING DIRECT-FIRED HEATERS"

For more facts circle 601 on Reply Card



"FOOTBALL FIELD" LIGHTING cuts plant lighting costs!

The explosion hazards in a gasoline processing plant usually make lighting costly—explosion-proof fixtures, circuits and controls are required. But not at this plant operated by the Sun Oil Company at Laverne, Oklahoma.

The lighting engineers put the Wide-Lite floodlights *out* of the danger area—on 50-foot poles around the perimeter of the plant. With a 480-volt system, the cost of transformers is reduced, and smaller cable can be used. By lighting the plant like a football field, the ingenious engineers cut installation costs.

The installation saves money on operating costs, too. The mercury vapor lamps last 9,000 to 12,000 hours—up to 12 times longer than incandescents. Power consumption is much lower. And Wide-Lite's rugged construction—with cast aluminum body and tempered glass lens to protect the lamp and reflector—keeps maintenance at rock bottom.

Find out how Wide-Lites can save for *you*—inside your plant and outside.

Send coupon today.

Patented

WIDE-LITE®

HIGH EFFICIENCY FLOODLIGHTS

OUTDOOR AREA LIGHTS
VAPOR TITE MODELS
INDOOR WORK LIGHTS
MOBILE WORKING LIGHTS
SPORTS LIGHTS
PROTECTIVE LIGHTS

In Canada:
Wide-Lite Division,
Wakefield Lighting, Limited,
London, Canada

WIDE-LITE CORPORATION Dept. S111
P. O. Box 191, Houston 1, Texas

Please send more facts on Wide-Lites. No obligation, of course.

Name_____

Company_____

Address_____

City_____ Zone_____ State_____

For more facts circle 602 on Reply Card

PLANT ENGINEERING EQUIPMENT

(Begins on page 164)

ing air, oil water, gas, steam, solvents and chemicals, and corrosive materials. Company says tape will not cake or harden, and will prevent freezing of joint, and allow disassembly. Johns-Manville Corp.

▲ For details, circle 29 on Post Card

COMPACT KIT for replacing removable faucet seats

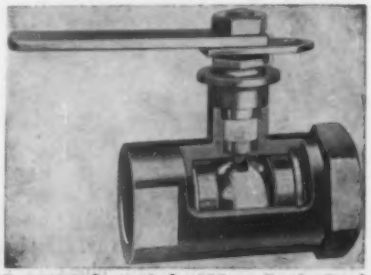
No. 24-B Handy Andy is a metal kit containing 100 assorted removable full-saddle faucet seats, three sizes of

wrenches, and a gage providing 33 tappings for determining exact size and type removable seat required to replace the worn one. Company's removable full-saddle seats are made of Sex-ite, a manganese-silicon-copper alloy described as rust proof, corrosion resistant and greatly outlasting brass. J. A. Sexauer Mfg. Co., Inc.

▲ For details, circle 30 on Post Card

BALL VALVES will handle variety of fluids

Offered in combination of metals, seats and seals to handle all types of fluids, this line of ball valves includes valves with Navy G bronze or semi-steel cast bodies; or brass, steel, and 303 or 316 stainless steel bar stock bodies. Both cast and bar stock types have full-round pipe-sized passage for fluids, or restricted passage as desired. With flex-



For more facts circle 603 on Reply Card →

HERE!

ADD UP TO 4% TO YOUR NET PROFIT

Caught in a profit squeeze? The contents of the Texaco man's briefcase can help you do something about it. Inside is Texaco's "Stop Loss" Program. It's a new cost control tool that can knock as much as 15% off your maintenance costs by showing you how to organize your lubrication. You can tack this saving directly onto profit—for an average 4% net gain. It will pay you to get the details. Write for our folder "How to Starve a Scrap Pile." **TEXACO** INC., 135 East 42nd Street, New York 17, N. Y. Dept. E-180

Monile unharmed by multi-ton steel wheel paper trucks since 1957.

MONILE COPOLYMERIZED FLOORS resist spalling and crumbling under heavy trucking ...hard shock...severe vibration...

Monile unaffected by dropping milk cans—lactic acids since 1956.

resist destructive acids, alkalies and salts...

No floor erosion despite severe wear since 1957. Inspectors praise Monile.

resist damage from soaking of oil, grease and water.

Monile gives you time-assured performance...is like new after years of service—under conditions destructive to industrial floors. Monile is applied directly over old or new floors—concrete...wood...brick ...tile. See Sweets Plant Engineering File $\frac{5f}{MAS}$ or write for 8-page brochure. **The Master Mechanics Co., Cleveland 28, Ohio or The Master Mechanics Chemicals Co., (Canada) Ltd., Toronto 14, Ontario.**

THE MASTER MECHANICS COMPANY

For more facts circle 604 on Reply Card

PLANT ENGINEERING EQUIPMENT

(Begins on page 164)

ible self-forming Teflon seats and seals (other materials available soon), valves range from ¼ to 2½ in. for pressures to 400 lb wog, and temperatures to 450 F. Sec. 5, Ref. Book 39 gives more data. Homestead Valve Mfg. Co.

▲ For details, circle 31 on Post Card

AIR VIBRATOR speeds unloading of hopper cars

The Navco HCP line of heavy-duty air vibrators for unloading covered railroad hopper cars is designed with an exceptionally long piston stroke for maximum amplitude and thrust, and the

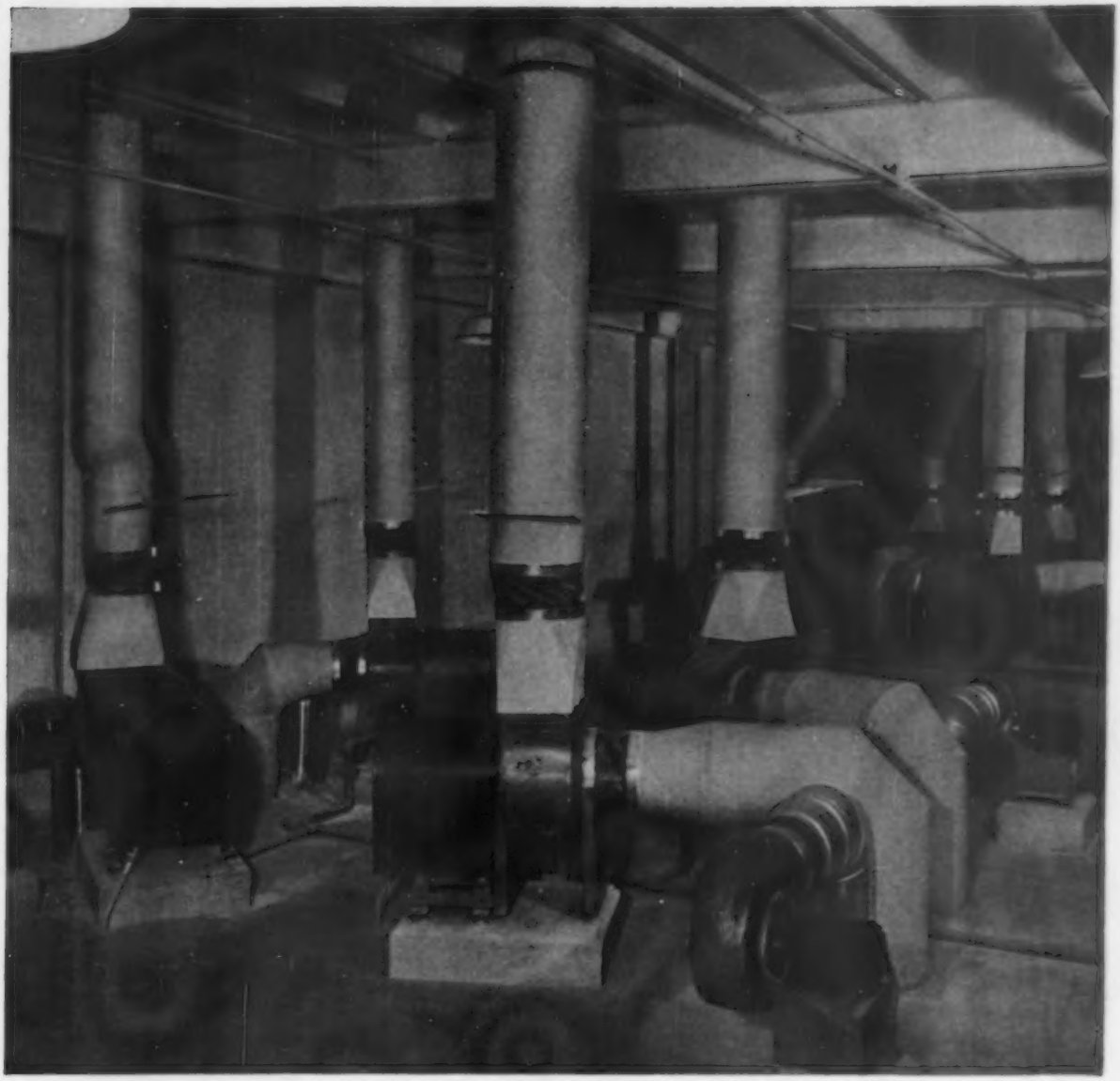
piston is the only moving part. According to manufacturer, units reduce unloading time, eliminate "clean-out" of cars after emptying. Two models are available—the 3-in. piston size is 14¼ in. long, weighs 68 lb and consumes 18 cfm at recommended air pressure of 40-60 psi; the 4-in. piston size is 17½ in. long, 115 lb, consumes 29 cfm at 40-60 psi. National Air Vibrator Co.

▲ For details, circle 32 on Post Card

TEMPERATURE REGULATORS for storage type heating, cooling

Leslie-Eventemp Regulators are introduced to meet the need for units that will "full stroke" the valve with a smaller temperature change than for vapor pressure or gas filled type regulators used in storage type heating and cooling services. These are single-seated, self-contained units, diaphragm actuated, with a lever-type internal pilot. There are only two moving parts in the body; no close fitting parts. Temperature variations are sensed by a liquid filled thermo-element which is interchangeable when the regulator is on the line.

These regulators are for continuous or standby service on storage and proc-



How to keep maintenance dollars *from going up the smokestack*

These ducts won't ever rust out paper-thin. They can handle corrosive fumes at much lower cost than ordinary ducts—last *years longer without a sign of deterioration.*

They cost less to install because they're so light, easy to handle and to support. Abuse will not dent, crack, or shatter them. They never need paint, and their glass-smooth surface is a cinch to keep clean.

Fire-safe—naturally. Ducts like these can meet the stiffest safety requirements because they are made with Hetron,® the flame-retardant polyester plastic. Hetron is inherently self-extinguishing. It can't ever contribute to a fire. In severe flame-spread tests, it proves far safer than many common building materials.

If you want corrosion costs to drop out of sight, get whole fume-handling systems—ducts, blowers, hoods, tanks, trays, scrubbers, stacks—made of this rugged, safe material. (To be sure it's Hetron, ask for it by name or specify "fire-retardant grade.") We make the Hetron resin only. We'll gladly tell you where to find out about the equipment you need.

DUREZ PLASTICS DIVISION

HOOKER CHEMICAL CORPORATION, 9603 WALCK ROAD, NORTH TONAWANDA, N.Y.

HOOKER CHEMICALS PLASTICS

For more facts circle 605 on Reply Card

Another Tool Answer

by Snap-on

New Bung Starter Socket

Got a tough tool problem? Try SNAP-ON for the solution. Take this new SNAP-ON bung starter socket, for example. It fits practically any bung you'll find — on grease and oil drums; containers for chemicals, solvents, etc. It eliminates wasted time, damage to bungs and drums, and the skinned knuckles you get with makeshift tools. This socket will pay for itself over and over.

Fits every bung we've tried

The above photo is typical. Bungs come in a wide variety of sizes and types with many different styles and shapes of turning flanges. This socket handles every one we've checked.

Use this bung starter socket with any ½-inch drive wrench handle or impact wrench. Order a supply from your SNAP-ON representative. He will be happy to serve you for any of your tool requirements — work with you on tool-use problems, or place at your disposal SNAP-ON's creative engineering service. He's a hand tool specialist with wide experience. Call your nearest SNAP-ON branch or write us.

Here a worker removes a bung quickly, easily. Socket fits around the outside circumference of small bungs, the inside circumference of large bungs, enabling the specially shaped housing or spring-loaded tongue to engage the various bungs.

FOR ALL INDUSTRY

SNAP-ON TOOLS

8068-C 28th AVENUE • KENOSHA, WISCONSIN

For more facts circle 606 on Reply Card

PLANT ENGINEERING EQUIPMENT

(Begins on page 164)

ess heaters and coolers, stand pipe heater, lube oils storage heaters and other applications where it is desirable for heating and cooling to take place at a maximum rate until set point is reached. They can be had with cast iron or bronze bodies, screwed or flat ends, sizes from ½ to 4 in., for inlet pressure to 175 psi, temperature to 500 F. Leslie Co.

▲ For details, circle 33 on Post Card

Use the Reader Service Cards provided on pages 223-224 to ask for more information on this equipment. Circle item numbers of products in which you are interested.

DUAL FUNCTION UNIT provides supply and exhaust

The Twinalator is a single-impeller, package type air handling unit designed to provide supply and exhaust simultaneously. Its heart is a single fan wheel of cast aluminum, in which the outer annular portion circulates the air in the opposite direction to that circulated by the inner portion of the wheel. Only one opening is necessary, and since only one motor, drive

and starter are involved, initial and maintenance costs are lower. Housekeeping is reduced, because the fresh air supply is drawn from above the roof level where the atmosphere is cleaner. And, by providing a balance between supply and exhaust, drafty leaks around doors are minimized.

Supply, delivered under pressure by the Twinalator, can be directed by adjustable louvers at the unit or ducted to specific areas, minimizing the air volume needed. At the same time, the unit draws exhaust air from the space

(Acid) bubble bath can't etch concrete floor coated with NEW GLID-CRETE

Floors "floored" by acids and chemicals? Here's the answer . . .

New GLID-CRETE, based on a catalyzed epoxy resin, used to patch or resurface concrete floors was given the acid test. A 50% solution of hydrochloric acid was poured on bare concrete and on concrete topped with an ⅛" of GLID-CRETE. The concrete was badly etched. GLID-CRETE was unharmed—and will stay that way!

Easy to apply with spray or trowel, GLID-CRETE, is six times more abrasion and impact resistant than concrete. It offers many outstanding advantages in the maintenance, repair and construction of masonry floors and structures.

GLID-CRETE can save you money. Time too. Write today for complete information.

QUALITY Glidden PRODUCTS

MAINTENANCE FINISHES DIVISION
The Glidden Company
900 Union Commerce Building
Cleveland 14, Ohio
In Canada: The Glidden Company, Ltd., Toronto, Ontario

For more facts circle 607 on Reply Card

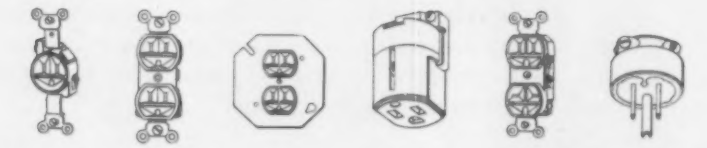
G-E Grounding Outlets simplify work for maintenance men.

1. Look — two 20A branch circuits with the flick of a screwdriver. You just remove breakoffs in this GE4108 Specification Grade Grounding Outlet, to get two circuits from a 3-wire, 120/240V service or from separate 120V circuits. Outlet accepts four types of caps, too.

2. You get eight back-wiring holes, with pressure-clamp terminals for Nos. 14, 12 or 10 Awg wires — plus four side wiring screws — two grounding screws.

3. Sturdy Construction, with double wipe contacts; "through" strap; captive mounting screws. 20A, 125V; U.L.-listed; meets Federal and REA specifications.

Get the "maintenance man's line" of grounding outlets and other wiring devices! Call your G-E distributor. General Electric Company, Wiring Device Department, Providence 7, Rhode Island.



15A, 125V, 250V | 15A, 125V, 250V, 277V; 20A, 125V | 15A, 125V, 250V | 15A, 125V, 250V | 15A, 125/250V | 15A, 125V, 250V, 277V; 20A, 125V

Progress Is Our Most Important Product

GENERAL ELECTRIC

For more facts circle 608 on Reply Card

PLANT ENGINEERING EQUIPMENT

(Begins on page 164)

and discharges it outdoors. Air can be exhausted from under the ceiling for general ventilation or ducted a reasonable distance from specific sources. Applicable for temperatures to 200 F and for gases and fumes, the unit is reported particularly suited to closed or semi-closed systems. In many cases, supply air need not be heated. Bulletin 552 gives information. Clarage Fan Co.

▲ For details, circle 34 on Post Card

CANNED PORTABLE PUMP for hard-to-handle fluids

This canned, self-priming portable pump is announced as self-lubricating and combining features of positive displacement type pumps with the general

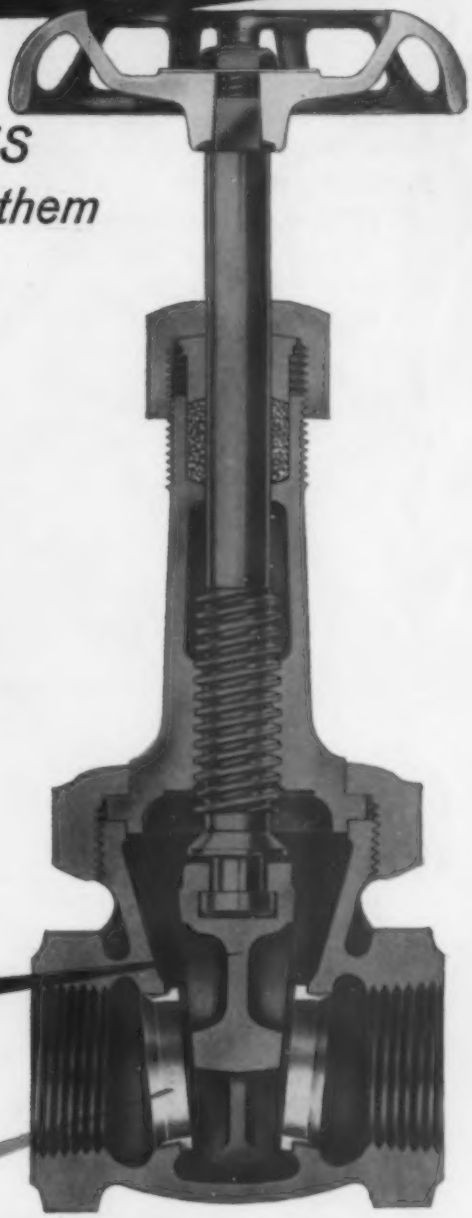
transfer abilities of centrifugals. It is suggested for emptying drums and tanks filled with corrosives, flammables, toxics or difficult-to-handle-fluids. Pump and motor are combined in one compact unit. It handles up to 11 gpm, temperature ranges from 40 to 180 F; creates heads to 55 ft and suction lifts to 15 ft. Available in cast iron, bronze or stainless steel. The Corley Co., Inc.

▲ For details, circle 35 on Post Card

TEMPERATURE CONTROLLER handles up to 10 processes

Multi-Point Temperature Controller is announced as providing automatic two-position control for as many as 10 separate processes. It can also be used as a single-point controller, a five-point three-position controller and a manual-balance indicator. Any points not being used for control of a multiple-temperature process, can monitor other processes. The unit combines a sensitive null-balance potentiometer measuring circuit with an electronic control system and is adaptable to any installation requiring off-on control.

It's Horse Sense . . .
Why Chance Leaks in Seat Rings



Get Monel Seat BRONZE GATES made the way JENKINS makes them

It's plain horse sense that you had better have the Monel seat rings EXPANDED (ROLLED) into the valve body if you want them to stay tight and leak-proof.

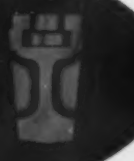
More horse sense . . . there's nothing valuable lost through having seat rings that can't be replaced by a regular maintenance man . . . **IF** the bronze or nickel alloy wedge has a lower degree of hardness than the heat-treated Monel seat rings. *(The way Jenkins makes them)* Then, the wedge takes the wear and seat rings are relatively unaffected.

Obviously, there's no faster, simpler or cheaper way to renew tightness and efficiency than to slip on a new wedge. And that, plus renewal of packing as needed, is all you need do to assure good performance from Jenkins Monel Seat Bronze Gates for as long as you'll need to care. Good service for scores of years is common.

Long, low-cost life also results from greater-than-ever-needed strength in every part of these valves. The records of millions of Jenkins Bronze Gates show you get full protection against all the stresses encountered in use.

Your local Jenkins Distributor will quickly supply your needs from a wide variety of Jenkins Bronze Gates. For information about these valves, write for folder No. 181-C. Jenkins Bros., 100 Park Ave., New York 17.

WEDGE is less hard than seat rings. Wear affects this easily replaceable part . . . NOT seat rings



SEAT RINGS are expanded (rolled) into body. Permanent, all-around support is essential to prevent deforming, loosening, shifting, LEAKS

JENKINS VALVES

LOOK FOR THE JENKINS DIAMOND

JENKINS SINCE 1864 Jenkins Bros

Sold Through Leading Distributors Everywhere

For more facts circle 609 on Reply Card

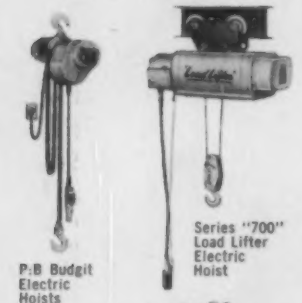
Lifting Made Easy

HOISTS AVAILABLE FOR EVERY LIFTING JOB

1✓ ELECTRIC HOISTS for frequent lifting with pace setting speed

2✓ AIR HOISTS to lift fast where atmosphere conditions are hazardous, corrosive, extremely hot, dirty or wet

3✓ CHAIN BLOCKS for easy lifting where the work cycle is moderate



P:B Budgit Electric Hoists

Series "700" Load Lifter Electric Hoist

ELECTRIC HOISTS

P:B Budgit® Electric Hoists. 1/8 to 2 tons. Modern push-button hoists for regular service. Portable. Two fully enclosed automatic brakes. Spotting action is fast, accurate. 1/2-ton load can be lifted at 34 FPM. Hook suspension. Trolleys available. Standard models for intermittent service — AC, DC, and 12-volt battery types — have pull cord control.

Load Lifter® Electric Hoists. 1/2 to 15 tons. For heavy-duty and production line service. Safe 24-volts at the push button. Single and 2-speed control. A ton can be lifted at 60 FPM. Two automatic brakes. Types for lug or hook suspension; also with push, hand-geared or motor-driven trolley. Hi-hook model increases length of lift.

Budgit Air Hoist

Load Lifter Air Hoist

AIR HOISTS

Budgit® Air Hoists. 1/4, 1/2 and 1 ton. Compact, lightweight hoists for regular lifting service. Link and roller chain types. Explosion proof motor. Spark and corrosion resistant link chain models. Speeds infinitely variable to 75 FPM. Pull cord control. Safety hooks standard. Rigid mount type and push trolley available.

Load Lifter® Air Hoists. 1 to 15 tons. Wire rope type for heavy-duty service. Five cylinder motor for smooth operation at all speeds. Speed infinitely variable to 37 FPM. Pull cord control standard; throttle control available. Mechanical load brake adjusts itself. Lug, push trolley, and hand-geared trolley suspension.

Tugit

Budgit Aluminum Chain Block

Budgit Army Type Chain Block

CHAIN BLOCKS

Tugit® . . . the Lever-Operated Hoist. 3/4 to 3 tons. Light. Compact. Portable. Operates easily at any angle even in close quarters. Has countless uses in every industry. Spur-geared for highest efficiency. A 42-lb. pull on the handle lifts 2 tons. Spark and corrosion resistant models.

Budgit® Chain Blocks. 1/4 to 10 tons. For production or maintenance. Combine light, strong aluminum frame with spur-geared lifting and automatic load brake. 25 lb. pull on hand chain lifts 1/4 ton. Hook suspension standard. Trolleys available. Army-type Budgit has integral trolley that can be adjusted to fit several sizes of I-beams and permits high hook lift. Ask about spark and corrosion resistant models.

SOLVE YOUR LIFTING PROBLEMS. Call your nearby Shaw-Box Distributor for practical help in selecting the best type of overhead load handling equipment — hoist or crane — for each task. Or, write us for literature.

D

MANNING, MAXWELL & MOORE, INC. TRADE MARK

OVERHEAD LOAD HANDLING EQUIPMENT

Products of

MANNING, MAXWELL & MOORE, INC.

Shaw-Box Crane & Hoist Division • Muskegon, Michigan

In Canada: Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario.

For more facts circle 610 on Reply Card

PLANT ENGINEERING EQUIPMENT

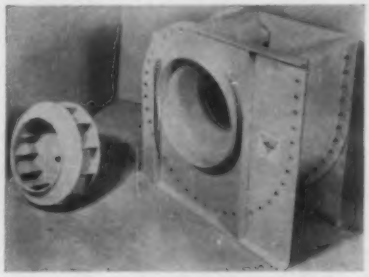
(Begins on page 164)

Controls and switches are on front panel. In addition, ten white lights show scanning position, ten red lights show process condition and ten knobs provide for easy setting of controls. The controller is compact—with 19-by-10½ in. frontal area, 15 in. deep. Thermo Electric Co., Inc.

▲ For details, circle 36 on Post Card

BLOWER HOUSINGS, FANS offer chemical resistance

Duracor reinforced plastic centrifugal blower housings with Duracor-covered standard fan wheels are said to offer great chemical resistance plus high strength/weight ratios. The units can be installed as separate components



in existing systems or designed into entire Duracor exhaust systems. The unit shown is part of a system designed for a chemical plant; it handles free chlorine fumes at temperatures to 250 F at 12,000 cfm. Bulletin 10-C gives information. The Ceilcote Co.

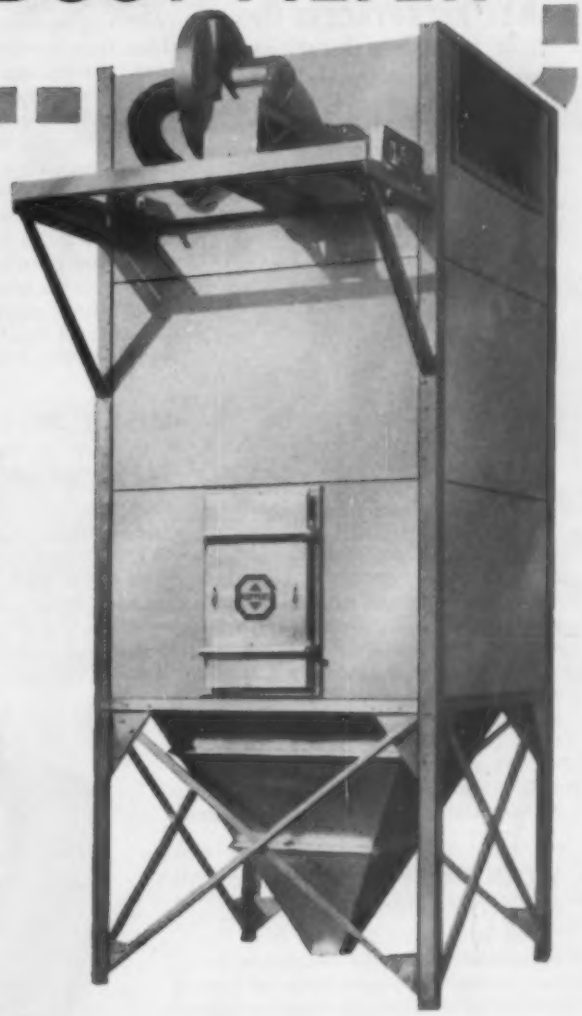
▲ For details, circle 37 on Post Card

SOLENOID VALVE for low pressure applications

This compact solenoid valve, having ¾-in. pipe connections, forged brass body and bonnet and soft composition disc, is primarily designed to handle gas to industrial and commercial type power boilers and fur-

Reverse-air jet filtering comes of age with the

NEW KOPPERS MODEL K AEROTURN® DUST FILTER



NEW PERFORMANCE

Highest filtering efficiency and increased capacity are benefits you get in the all-new Model K Aeroturn. Fifteen years of diversified application experience have combined to produce a dust filter offering the utmost in performance and reliability.

NEW ECONOMY

Revolutionary new self-adjusting blow rings and proven pressure controlled filter cleaning reduce wear — increase filter tube life — cut operating expense. Rugged, simplified construction virtually eliminates maintenance costs and downtime.

NEW FEATURES

Koppers Model K Aeroturn has been completely redesigned for demanding industrial service—the only new reverse-air jet filter on the market. Such features as new blow rings, new carriage drive system and simplified, standardized design help you recover more product, cost less to operate and serve you more dependably.

NOW, MAIL THIS COUPON for complete information!

KOPPERS

AEROTURN® DUST FILTERS

Engineered Products Sold with Service

KOPPERS COMPANY, INC., Dust Filter Dept.,
4203 Scott Street, Baltimore 3, Md.

Gentlemen: Please send me a free copy of your new Aeroturn brochure complete with descriptions, drawings and photographs.

Name..... Title.....

Company.....

Address.....

City..... Zone..... State.....

For more facts circle 611 on Reply Card

PLANT ENGINEERING EQUIPMENT

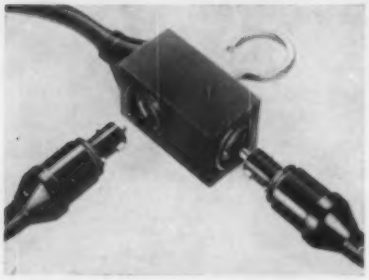
(Begins on page 164)

naces. However, it can be used in any low pressure control system—for example, as an electrical checking device for vacuum pumps and systems. Automatic Switch Co.

▲ For details, circle 38 on Post Card

PLUGS, RECEPTACLES for use in hazardous locations

Explosionproof Industriline Plugs and Receptacles are announced for safe, rapid connection and disconnection of electric lighting and power distribution systems in hazardous areas. Units may



be used with two-, three- or four-wire circuits rated up to 240 v, 15 amp or 120 v, 30 amp. Contacts of electrical-grade copper are encased in Neoprene bodies. It is pointed out that when a plug is inserted into a receptacle, a lip on the former fits a collar on the latter to form a sealed chamber in which contacts engage and close circuit—making it impossible for spark to ignite explosive atmosphere. Blocks with four and six receptacles are also available. J. B. Nottingham & Co., Inc.

▲ For details, circle 39 on Post Card

WOOL MOP brightens floors, gets corners clean, too

Called the Hospital Magnetic Mop, this swivel-headed dry mop is suggested for use in sanitary maintenance of food processing and other plants. All-around cleaning efficiency is attributed to its head—made of virgin wool blends. Wool is electro-static, manufacturer points out, and builds harmless charges that literally "pull" dust to the mop head—even from hard-to-reach corners. Also, wool fibers are toothed and crimped forming dust traps along each strand, so that the mop holds more dust—requires less frequent shaking-out. And since it contains lanolin, the wool picks up fine, powdery grit, too, and helps preserve and brighten waxed floors. The removable wool head is said to launder well and dry fluffy. Handle is 54 in., providing an extra-long reach, and the swivel feature enables getting the head around machines and equipment. The head takes in a foot-wide cleaning swath. The unit costs around $5.00; a non-swiveling one costs less. New England Mop Co.

▲ For details, circle 40 on Post Card

SYNTHETIC DETERGENT is all-purpose cleaner

Goodyear All Purpose Cleaner (APC) is suggested for use on anything from removing grease and oil from mechanical parts and machinery to keeping buildings, floors and windows clean—as well as for washing hands after grimy jobs. Parts can be cleaned by soaking in a vat or tank with 1 oz of APC to every 20 or 30 parts of cold water. A solution of 1 oz in a gallon of hot or cold water can be used to remove wax from floors. The cleaner is odorless and non-toxic, manufacturer says; safe for hands. Consolidated Paint & Varnish Corp.

▲ For details, circle 41 on Post Card

MIST, FUME COLLECTOR has multi-stage filter

The Chafco Fumist employs a three-stage separator and filter system. It first separates 98 per cent of the mist by cyclonic action. Part of the mist is dried in this stage, the remainder being collected in a plastic receptacle. The remaining 2 per cent mist, entering the second stage, is drawn through a filter cartridge having alternate layers of

fiber glass and activated carbon, which collects mist by impingement and absorption. The filter cartridge can be removed and recharged.

Smallest of three standard models, is one priced around $220, powered by a ½-hp single-phase motor operating at 3450 rpm. Capacity is 350 cfm at 1½-in. static pressure. The unit measures 24 in. square, is 45 in. high. A 1-hp model, priced around $320, has a capacity of 800 cfm, and a 2-hp model, at $440, a capacity of 1200 cfm. Where

ANOTHER NEW ACHIEVEMENT IN MODERN FLOW CONTROL BY CRANE

1 Single retaining nut holds cartridge assembly in body, for fast, foolproof dismantling and assembly

2 Teflon* thrust washer reduces stem friction; absorbs line pressure load on ball

3 Teflon* seats pre-loaded for tight shut-off with minimum torque

4 Bright plastic grip insulates handle and flags valve position

5 Positive, Standard Size O-ring seals on stem, cartridge

6 Self-aligning, precision-machined ball, polished and chrome-plated to minimize friction and wear on seats.

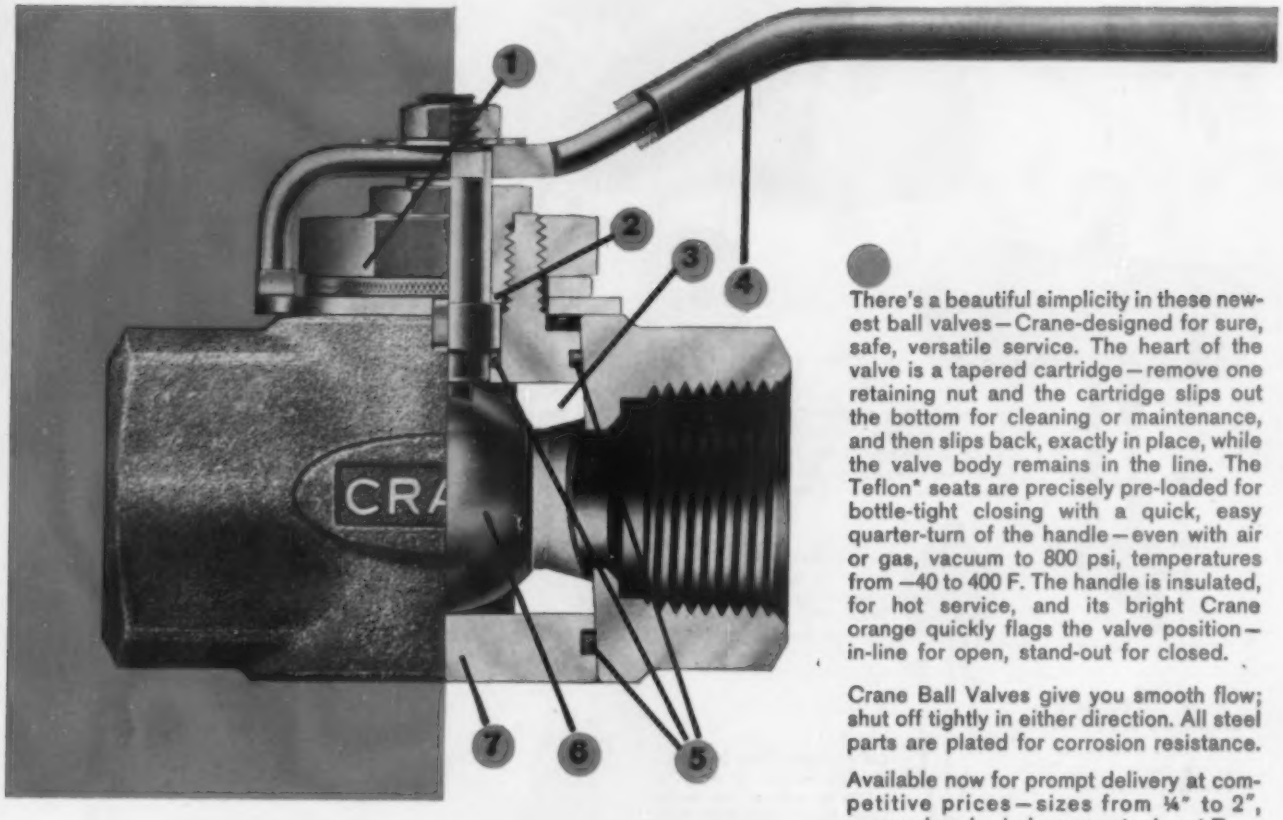
7 Tapered cartridge contains all working parts; slips out bottom in one piece for cleaning or maintenance

* Teflon is a registered trademark of E.I. DuPont de Nemours & Co., Inc.

CRANE BALL VALVES

with the exclusive tapered cartridge that drops out for fast, in-line servicing

designed to handle all air and water services to 400 F



There's a beautiful simplicity in these newest ball valves—Crane-designed for sure, safe, versatile service. The heart of the valve is a tapered cartridge—remove one retaining nut and the cartridge slips out the bottom for cleaning or maintenance, and then slips back, exactly in place, while the valve body remains in the line. The Teflon* seats are precisely pre-loaded for bottle-tight closing with a quick, easy quarter-turn of the handle—even with air or gas, vacuum to 800 psi, temperatures from —40 to 400 F. The handle is insulated, for hot service, and its bright Crane orange quickly flags the valve position—in-line for open, stand-out for closed.

Crane Ball Valves give you smooth flow; shut off tightly in either direction. All steel parts are plated for corrosion resistance.

Available now for prompt delivery at competitive prices—sizes from ¼" to 2", screwed ends, in bronze, steel and Type 316 stainless.

Call your Crane Distributor or send today for a complete, illustrated folder on the outstanding new Crane Ball Valves, engineered for unmatched service.

CRANE

CRANE CO. Industrial Products Group
4100 South Kedzie Ave., Chicago 32, Ill.
In Canada, Crane Ltd., 1170 Beaver Hall Square, Montreal

Valves/Electronic Controls/Piping/Plumbing/Heating/Air Conditioning

For more facts circle 612 on Reply Card

Choice of the wise buyer who compares...

CM HOISTS

CM METEOR ELECTRIC WIRE ROPE HOIST ½ to 5 ton capacities—Compact, enclosed design. Low headroom. Continuous duty motor with thermal overload protection for heavy duty service. Precision bearings and helical gears for long life. Only 110 volts at push button control. Hook suspension; plain, geared or motor driven trolley.

CM LODESTAR ELECTRIC CHAIN HOIST—⅛ to 2 ton capacities—First truly heavy duty version of small electric hoist. ¼ ton model weighs only 51 lbs. Heavy duty self-adjusting brake, plus exclusive regenerative electrical braking. Upper-lower safety limit switches. CM-Alloy load chain. Single and three phase.

HAND OR ELECTRIC CHAIN OR WIRE ROPE

CM makes them all! So you can choose a hoist that's perfectly suited to your specific needs in a compact, rugged and safe CM design.

CM TROLLEYS AND CRANES

CM CYCLONE Hand Chain Hoist—⅛ to 10 ton capacities—Easy to carry. One ton model weighs only 36 pounds. Made of tough aluminum alloy. CM-Alloy load chain. High efficiency. Lifetime lubrication.

CM PULLER—"The One Man Gang"—¾ to 6 ton capacities—Lifts or pulls at any angle. Lever handle operation Automatic load brake holds at any point. ¾ ton model weighs only 13 pounds and fits in a tool box. CM-Alloy load chain.

● **FOR OVER 75 YEARS,** Chisholm-Moore has offered hoist buyers the newest and most efficient designs, the most rugged construction, and the greatest number of valuable operating and safety features. CM hoists operate with a very minimum of maintenance. They give years of satisfying service.

Request catalog and name of local stocking distributor.

CM HOISTS

CHISHOLM-MOORE HOIST DIVISION
COLUMBUS McKINNON CORPORATION
TONAWANDA, NEW YORK
REGIONAL OFFICES: NEW YORK, CHICAGO, CLEVELAND

In Canada: COLUMBUS McKINNON LIMITED, ST. CATHARINES, ONTARIO

For more facts circle 613 on Reply Card

PLANT ENGINEERING EQUIPMENT

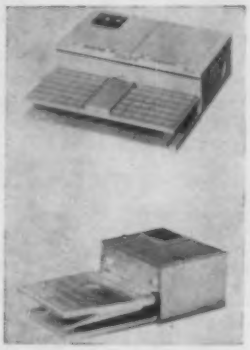
(Begins on page 164)

floor space is limited, units can be suspended from the ceiling. Chicago Air Filter Co.

▲ **For details, circle 42 on Post Card**

FOOT SWITCHES for a-c and d-c pilot circuit control

Both Type A Standard Duty and Type C Heavy Duty C-H Foot Switches are designed for a-c and d-c pilot circuit control. Contact mechanism in the treadle-operated devices is a precision unit switch having single pole,

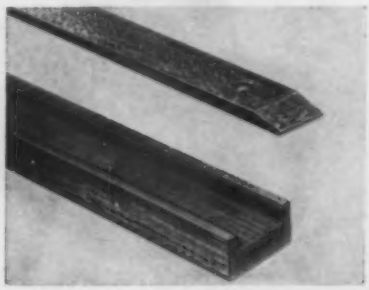


double throw, twin break, silver contacts (N.O. - N.C.) and is enclosed in a moulded phenolic block. The standard duty switch is two-position, spring return and front treadle operated. The heavy duty switch contains two contact blocks and is side treadle operated, adjustable from three-position spring return to two-or three-position maintained contacts. Cutler-Hammer, Inc.

▲ **For details, circle 43 on Post Card**

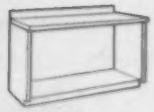
WEAR STRIP for use on conveying machinery

Self-lubricating wood wear strip, POBCO, is designed to reduce friction, increase operating speeds and eliminate tie-ups in production caused by jamming, incorrect timing, bottle breakage, or damage to mechanical components of conveying machinery. Company says



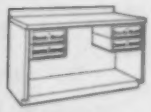
HALLOWELL

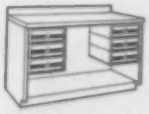
CABINET BENCHES

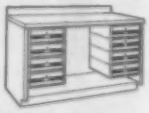

Model 608-Basic Bench

Two adjustable shelves

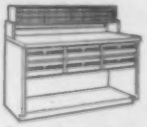
Two shelves, sliding doors and lock


Two 2-drawer tiers


Two 3-drawer tiers


Two 4-drawer tiers

Two shelves and top shelf


Drawer tiers and storage wall

Two shelves, sliding doors and drawer tier

Electrical panel, shelves and sliding doors

Three 2-drawer tier units

Top shelf, shelves and sliding doors

There is a standard HALLOWELL Cabinet Bench for every job. Drawers, doors, electrical panels or test panels, shelves and other interchangeable accessories give you what you need *now*—yet enable you to rearrange or add as work requirements change. Built to last indefinitely. Ask your HALLOWELL distributor for full information, or mail coupon below.

COLUMBIA-HALLOWELL Division SPS
Jenkintown 26, Pa.

Please send me the full line Hallowell Shop Equipment Catalog.

NAME_____
Please Print

COMPANY_____

ADDRESS_____

CITY_____ ZONE_____ STATE_____

COLUMBIA-HALLOWELL Division **SPS** JENKINTOWN 26, PA. • SANTA ANA, CALIFORNIA

where reliability replaces probability

For more facts circle 614 on Reply Card

BRUSHES
WE
DON'T
MAKE
But don't let this fool you. Though we don't get into the toothbrush business, we do design and manufacture all types of brushes used by today's industry. If you have a special brush problem or simply a need for a standard design, our engineers will be glad to call on you. They are trained to analyze your problem and make a recommendation which entails no obligation. Newark Brush Company has been specializing in industrial brushes since 1894. Your inquiry will receive our best attention.
SINCE NEWARK 1894
59-47

Leadership Proved Through Performance!

NEWARK BRUSH COMPANY

260 MICHIGAN AVE., KENILWORTH, N. J.

For more facts circle 615 on Reply Card

PLANT ENGINEERING EQUIPMENT

(Begins on page 164)

it may be bored, counterbored, slotted, grooved, tapped or rabbitted to conform with mounting specifications, it comes in many thicknesses and lengths. Paramount Oilless Bearing Co., Inc.

▲ For details, circle 44 on Post Card

ACOUSTICAL BOOTH permits noise-free telephoning

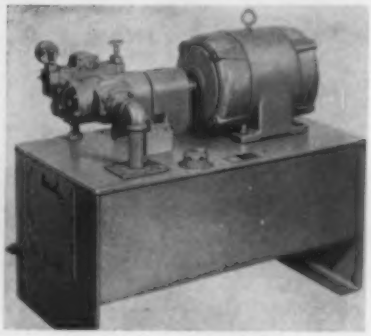
Inside wall and ceiling panels of No. 45 Acousti-Booth have been acoustically treated to permit private conversations undisturbed by surrounding

noise in such areas as factories, transportation terminals and lobbies of public buildings. Designed for economy of space, the steel booth may be installed free-standing on steel legs or wall mounted. Burgess-Manning Co.

▲ For details, circle 45 on Post Card

POWER UNIT uses double pumps and valve panel

By utilizing double pumps in conjunction with Hi-Lo unloading valve panel, horsepower requirements are reduced, oil temperatures lowered, and maximum circuit efficiency realized, ac-



cording to manufacturer of the 1000- and 2000-psi DCP Double Pump Power Units. Units are offered in standard

Free kilowatts from the sun... delivered daily with non-glare Johns-Manville CORRULUX

The finest natural lighting your plant can have is the soft, diffused daylighting you get with Corrulux panels by Johns-Manville. These fiber glass reinforced translucent plastic panels will admit over 80% of the light striking them, depending on color, yet eliminate glare, spotlighting and harsh shadows because they diffuse light at all angles.

Corrulux is shatter-proof and splinter-proof. It works readily with hand or power tools. It comes in a wide variety of colors and sheet sizes, both corrugated and flat. Available corrugation dimensions match J-M Corrugated Transite and other standard building materials.

For further details, look in the Yellow Pages under *Plastics*, or write Johns-Manville, Box 158, Dept. PE-361. New York 16, N. Y. In Canada, Plastics and Allied Building Products, Ltd., Dundas, Ontario.

JOHNS-MANVILLE

JOHNS-MANVILLE JM PRODUCTS

CORRULUX and TRANSITE are registered trademarks of the Johns-Manville Corporation

For more facts circle 616 on Reply Card

New Ideas On Dust And Fume Control

Simplified vessel and tube support construction speed assembly

New Products:

John Wood High Efficiency Fabric Filter

John Wood Fabric Filters are engineered for 99.9% efficiency in addition to trouble-free operation. They are the result of a program to design equipment for fully effective removal of all dry dusts at elevated operating temperatures.

An extremely varied group of filter sizes, shapes and types is available in capacities from 100 CFM to 48,000 CFM. Larger volumes are handled through a combination of units. John Wood automatic reverse flow mechanisms or shaker assemblies assure proper and gentle cleaning of fabric. Tubular or envelope bags are made of cotton, orlon, dacron, nylon or glass to meet any requirement.

New Engineering: **John Wood Fabric Filters are but part of the complete line. Other equipment includes Interphase Reaction Scrubbers, Multi Cyclones, Involute Cyclones, Venturi Scrubbers and combination units. New designs are now under development.**

New Service: **John Wood Air Pollution Control is fully programmed from analysis of existing conditions to equipment installation. Frequently economies result that make the installation self-liquidating through lower maintenance and replacement costs.**

Write for engineering assistance or specific product information. An air pollution preliminary analysis kit is available without obligation.

AIR POLLUTION CONTROL DIVISION
JOHN WOOD COMPANY
2 NICOLET AVENUE FLORHAM PARK, N. J. TUcker 7-3200

For more facts circle 617 on Reply Card

PLANT ENGINEERING EQUIPMENT

(Begins on page 164)

30- and 60-gal reservoir sizes, with combined pump capacities to 33 gpm. They are designed for service in situations where rapid advance and slow, constant feed is desired. Units can also be supplied with two individual relief valves instead of Hi-Lo panel, when two separately operated hydraulic systems are required. Hannifin Co.

▲ For details, circle 46 on Post Card

Use the Reader Service Cards provided on pages 223-224 to ask for more information on this equipment. Circle item numbers of the products in which you are interested.

LIFTING MAGNETS simplify handling of coiled steel

Designed to permit faster, safer and damage-free handling of hot or cold strip coiled sheet steel, these four-pole magnets come in sizes to handle coils

weighing up to 80,000 lb. Each pole is a separate magnet with its own Class G, high temperature insulated coil. Coil assemblies are enclosed and watertight. Stainless steel enclosures are designed for steel mill requirements, incorporating a heat barrier to protect magnet coils. A heavy-duty housing protects lead-ins and waterproof terminal box. Stearns Magnetic Products.

▲ For details, circle 47 on Post Card

ACCESSORIES IMPROVE protection of pressure gages

Similar in design, a pulsation dampener and a chemical attachment are announced as offering improved performance and easier maintenance where gages must be protected from

ONE OF A SERIES OF CHATS ABOUT CONSERVATION AND CONTROL OF HEAT

SARCO TOPICS

MODERNIZING A STEAM SYSTEM MEANS TRAPPING, TOO

Take an older building that has generated its own steam for decades and let's say it's switching to district steam. How can it take advantage of switch-over to rid itself of those classic symptoms of antiquated systems: trap maintenance at overtime rates, water-hammer, and live steam loss?

Well it just so happens a 17-story office building at 635 Madison Avenue, New York, recently did just that. Its steam system was overhauled; but recovery is now complete and it didn't hurt a bit.

First, let's look at the system as it was: Maintenance of the old system had to be done at overtime rates in off hours, because the system could not be shut down during business hours. There were frequent breakdowns. Passage of live steam into return lines when traps failed open not only wasted energy but caused water hammer, and when traps failed closed, water accumulated in steam supply mains and equipment.

The reason we give you this dreary picture is that it's so typical of old systems, and so easily fixed. The building management simply replaced bucket and float traps with Sarco Thermo-Dynamic Steam Traps, Type TD-50, matched and correctly sized to the application. And at the risk of sounding like a TV commercial, results were immediate: maintenance practically

zero, no water hammer, no loss of live steam, engine room crew free for other jobs. And, need we add, considerable savings.

We find it difficult to be modest about the TD-50 because it comes so close to being a cure-all. The facts are these: It has only one moving part, a stainless steel disc; it shuts off *positively*, so no steam can be lost; it discharges condensate as rapidly as it is formed; its pressure range of 10-600 psi makes it possible to standardize on one steam trap for a variety of applications that formerly required traps of many types and ratings.

Funny thing is, the TD-50 is so dog-gone *simple* and *small*, people find it hard to believe it does what it does. At 635 Madison Avenue, for example, changeover took only 30 minutes per trap, and trapping was accomplished with a few pounds and cubic inches of traps where hundreds of bulky pounds were needed before to do the job.

Write us for details, won't you? You've nothing to lose but your troubles, your waterhammer, and your worries.

HEATING COILS CAN CATCH COLD

Let's face it: even the best "non-freeze" air heating coils may freeze if they handle incoming air even slightly under 32°F. and aren't drained properly. Let's face it again: It's *not* inadequate steam trapping capacity that's most usually to blame. We don't mean to belabor the point, but if trap inlet pressure falls lower than trap outlet pressure, condensate *is* going to collect in the coil. And it's *bound* to freeze below 32°F. Take a preheat coil designed to heat air from 0°F. to 50°F. using steam at a maximum pressure of 10 psig. As the outside air temperature rises above 0°F. heat demand decreases, the temperature controller reduces the steam pressure to compensate for reduced heat demand, and you're ripe for ice cubes in your coil tubes.

At Sarco we firmly believe that practical help is much more useful than sympathy noises. We can tell you (if it happens to be *you* who are caught with your temperature down) of at least three cures for fatal drop in pressure differential. They're quite simple and we would show not the slightest hesitation about revealing them to you.

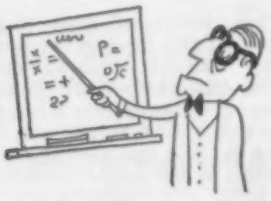
In fact, we'd also like to send you a master chart that enables you to check at a glance the danger point in handling outside air—an extremely useful piece of information—and a bulletin on Float-thermostatic steam traps.

It may hasten matters if, when you request this bundle of facts, you refer to the literature as Sarco Technical Bulletin No. T503.

MORE THAN ONE WAY TO TRAP STEAM

Just as there's no universal trapping application, there's no universal steam trap. The fact is that there are five basic steam traps in use today—and they're all rather thoroughly described in a rare monograph by Sarco engineers titled modestly and succinctly enough: Lecture 1A. You, personally, may not need a copy of this fundamental document, but wouldn't you like to know that your own people were up to date on steam trap basics?

It's easy to be sure this vital information gets into their hands: simply request a quantity of Lecture 1A and distribute copies as needed, with a little subtle persuasion that they be read. We can even arrange for a personal slide film lecture, followed by authoritative answers to trapping questions, if you can get an in-plant group together.



In any event, write to us. You may discover that a lot of progress is being made that isn't concerned with getting men to the moon.

Pardon our monopolizing the conversation in this series of paid communiques, but we're trying our best to interest you in certain subjects that concern us both—to the point where you'll communicate. 5108

SARCO

SARCO COMPANY, INC.
635 MADISON AVENUE, NEW YORK 22, N. Y.
PLANT: BETHLEHEM, PA.
STEAM TRAPS • TEMPERATURE CONTROLLERS
STRAINERS • HEATING SPECIALTIES

For more facts circle 618 on Reply Card

ENDS BOTTLENECKS

The PREST-O-MATIC® Door

takes the STOP out of

"Stop and Go" traffic

Quick-acting PREST-O-MATIC works *for* you, not *against* you. Fully automatic, it prevents slow-downs and bottlenecks — saves you man hours aplenty.

Your fork truck driver simply pulls an overhead cord and goes through the opened door without stopping. The door opens and closes *Prest-O-Matically* in as little as 2 seconds. Compare this with manual doors that require your driver to stop, dismount, open the door, return to the truck, drive through . . . then stop to close the door again! Multiply this waste motion by the number of trips per day . . . per *year*.

Engineered to snug-fit your doorways, PREST-O-MATIC remains tightly closed when not in use. Neoprene Sealing stops drafts, eliminates heat or air-conditioning loss.

Complete in one easy to install unit. No extras. Available in Bifold (shown here) and Sliding. You choose the motive power — air or electric. Before you buy any door, get all the facts on PREST-O-MATIC. See our insert in Sweet's Catalog or, better still, write us today.

CLARK DOOR COMPANY, INC. (since 1878)

807 Hunterdon St.
Newark 8, N. J.

For more facts circle 619 on Reply Card

PLANT ENGINEERING EQUIPMENT

(Begins on page 164)

pulsating pressures or corrosive chemicals. Both have a diaphragm (stainless steel or Neoprene) separating measured fluid from gage measuring element. Space above diaphragm is filled with a viscous non-freezing liquid which transmits measured pressure to the gage element. For pulsation dampening, there is an adjustable restriction in a passage from diaphragm top to gage. A feature is that it permits access to this passage at the side of the unit.

Company recommends that, where practical, the pulsation dampener or chemical attachment, be purchased as an integral unit with gage. Gages with the dampener can be used with fluid temperatures from 50 to 100 F without temperature correction. The chemical attachment is designed to prevent measured fluids from clogging or corroding the gage spring element. In addition, it can also be used for pulsation dampening. United States Gauge Div., American Machine & Metals, Inc.

▲ For details, circle 48 on Post Card

SHELVING uses one-piece support clip

Clip-Type Erectomatic Shelving has the same structural components as standard Erectomatic Shelving, except that it uses clips instead of full-depth support incorporated in the standard line. It is introduced for applications requiring easily adjustable shelves but not the extra strength offered by full-depth shelf supports. The clips at the four corners

are said to provide more than enough strength for most loads, and the two forms of support can be combined in the same unit of shelving. The clip operates like a strong hanger that requires no hammering and attaches to the shelf in two places. Hooked at the top, it is hung on any of the ¾-in. wide post slots spaced 1½ in. apart. Two vertical prongs near the bottom of the clip fit in the next lowest slot. This double-grip feature is claimed to result in a positive locking action that eliminates shelf wobbling. Shelves resting on the clips can be lifted out and repositioned without disturbing the clips. Shelves can be placed as close as 3 in. Columbia-Hallowell Div., Standard Pressed Steel Co.

▲ For details, circle 49 on Post Card

CONTROL UNITS automate battery charging

The Exide Automatic Charge Control is designed as a mate for company's Hi-Lo Chargers used with batteries such as those supplying stand-by or intermittent power for emergency lighting and process equipment. It acts to vary charge rate of rectifier as required by battery and prevent overcharge or undercharge damage. When battery voltage drops below a full-charging value, the control unit puts the charger on high rate. After full-charge voltage is reached, the unit switches the charger back to a low trickle-charge maintenance rate. It checks on the state of battery charge every hour. Only routine maintenance, no manual adjustment, is required, says manufacturer, and components are

mounted on the door of a steel cabinet where they're readily accessible. The control unit can be designed for use with any Hi-Lo Charger to maintain any number of lead-acid or nickel-cadmium cells. Exide Industrial Marketing Div., The Electric Storage Battery Co.

▲ For details, circle 50 on Post Card

VENTILATING UNIT lowers heating cost

Reduced heating costs—up to 45 per cent—and more uniform, controlled temperature all year around are reported possible with Model ER (Dual Exhauster-Recirculator). It combines recirculation of heated air in winter and exhaust of hot air in summer into a single compact unit. During winter, a Divertco-Damper seals the top of the unit against heat loss. A three-positioned reversing switch controls fan direction. On the recirculating cycle, the fan blows air downward. Wasted heat trapped under the roof line is pulled into the fan and blown out diffuser openings at the bottom, carrying it back to floor area.

On the exhaust cycle, during summer, the fan blows air upward, pulling hot air into its path and exhausting it outside the building. The damper is lifted by the air column and seated against the underside of the weather dome. Its conical shape directs air movement so that it is exhausted without back pressure. Sizes range from 3000 to 23,000 cfm. Genie-Air Products.

▲ For details, circle 51 on Post Card

ECONOMY INTERCOM works anywhere

Model 1400, to be offered for around $35.00, is a two-station intercom system utilizing four transistors. It can be used anywhere, since it operates on standard penlight batteries and incorporates a "battery-saver" standby switch, of importance where the system must be on at all times.

Because of transistorized circuitry, no warm-up period is required. Also, the master station has a "beep" tone with which the remote station can signal the master. The latter need be turned only as necessary, manufacturer points out, and no battery drain takes place except during actual voice transmission. The system is furnished with 50 ft of two-conductor cable. Additional cable can be had, also additional remote units (costing around $9.00) to expand system as required. Fanon Electronic Industries.

▲ For details, circle 52 on Post Card

WALL COATING provides safety benefits

Glazetite is a spray-applied interior wall coating which, manufacturer reports, has achieved the combined rating of 0 for flamespread and 0 to 10 for smoke developed factor in tests run by Underwriters' Laboratories. It is also claimed virtually unaffected by most acids and alkalis; and, because its composition is over 90 per cent inorganic, to resist deterioration by oxidation, and moisture, abrasion and impact. Glazetite is available in virtually unlimited color combinations, and its high gloss finish resists dirt and stain penetration. Desco International Ass'n.

▲ For details, circle 53 on Post Card

(Continued on next page)

New RIDGID No. 141 Geared Threader

For 2½", 3", 3½", 4" Pipe and Conduit

Save Time...Cut Costs on all large threading jobs!

1. Only 1 Set of High Speed Dies threads 2½", 3", 3½" and 4" pipe and conduit. No extra die sets to change or lose! Die size selector plate sets quickly and locks at desired size. Easy adjustment for tapered, straight, over or under size threads.

2. Jam-Proof for safe threading by power or hand. Drive pinion kicks out automatically. Die head *Can't Jam* . . . avoids costly repairs and delay.

3. New Fast-Action, Cam-Type Workholder sets to size by quick turn of collar. Set screw holds work centered for perfect threads every time . . . adjustable for drip threads.

Your Supply House has them!
Order your new RIDGID No. 141 Threader today!

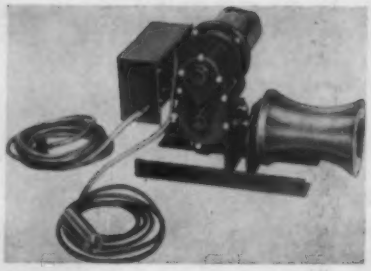
RIDGID®
The Ridge Tool Company · Elyria, Ohio, U.S.A.

For more facts circle 620 on Reply Card

PLANT ENGINEERING EQUIPMENT

(Begins on page 164)

PORTABLE WINCH-HOIST for use near power lines



My-te Capstan Winch-Hoist is announced as a portable (60 lb) electric unit for safe handling of manila rope near power lines. A battery model, costing around $240, works off any 6- or 12-v car or truck battery. A 110-v a-c model operates from a portable generator or other source, costs $280. Pulling capacity is listed as 500 lb with single line; 1000 lb with double line. Features include capstan speed of 32 rpm, gear ratio of 175 to 1, sealed gear housings, and 10-ft remote control cable with forward and reverse action. City Engineering Co., Inc.

▲ For details, circle 54 on Post Card

WIPING TOWEL designed for clean room operation

The Texel Lint Free Towel has been developed for use in electronics, missile and other industries requiring dust free areas. They are made of a non-abrasive, finely-woven cotton processed to eliminate lint. Other features include bound edges to prevent fraying, an 18-by-18 in. size, and treatment to prevent shredding and lint. Industrial Wiping Cloth Co., Inc.

▲ For details, circle 55 on Post Card

SAFETY BLOCK supports presses during die servicing

Saf-T-Bloc, an adjustable safety device is used for rapid snubbing of upper and lower dies while they are being cleaned, changed or sharpened or other press maintenance being done. A modified version of the bell base screw jack, the Saf-T-Bloc has three parts. A single base casting with integral

handle houses a steel screw having a knurled top for hand adjustments while on the press. There's a stop washer at the screw's base to prevent raising beyond safe limits. The unit weight about 11 lb, comes in various capacities and raises. The Saf-T-Bloc is attached to the press with a short length of chain and a safety plug. You can't use it before removing the plug from its position in the power control panel, manufacturer states; and once the plug is removed, power is automatically cut off. Returning plug to position actuates the press. Duff-Norton Co.

▲ For details, circle 56 on Post Card

REFRACTORY CEMENT for use over vertical boiler tubes

Super Blakite, ready mixed, air setting refractory, was developed as a refractory coating for use over vertical boiler tubes. It comes in a stiff

"...easy Joe, that baby's worth a quarter million!"

NEW DESPATCH OVEN DRIES TRANSFORMERS SAFELY, ECONOMICALLY

When products are worth $250,000 apiece, processing mistakes can be costly.

That's why Wagner Electric Co., St. Louis, called on Despatch for a moisture removal oven.

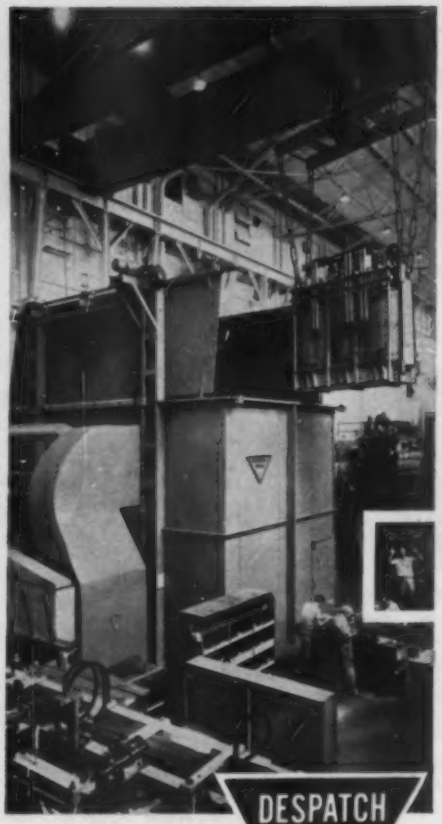
This new Despatch oven performs exactly according to specification. It also increases productive capacity and makes operations more versatile.

Drying Wagner's giant transformers—which range up to 100,000 kva—is a vital and critical step. Moisture must be removed, but heat must not damage insulation.

"We considered many other types," reports company official Charles Ruder, "but Despatch proved to be up to twice as economical."

Perhaps your firm has a similar problem. Our engineers will be pleased to discuss it with you . . . or any other in industrial heating, metal washing, spraying, etc. There's no obligation.

Write today for free bulletin 100GL.



DESPATCH OVEN CO.

Spray booth
Washer
Drying oven
Foundry oven (conveyorized)
Heat treat furnace (box type)
Heat treating furnace (pot type)
DESPATCH OVEN CO. 619 S.E. 8th St., Minneapolis 14, Minn.

DESPATCH—INDUSTRY LEADERS FOR 58 YEARS

For more facts circle 621 on Reply Card

Philadelphia Electric Company workers get sure footing despite oil film with **A.W. ALGRIP**

Hot, heavy oil occasionally spills on this walkway at the Schuylkill Station of the Philadelphia Electric Company, but A. W. ALGRIP helps prevent accidents by providing assured footing.

A. W. ALGRIP rolled steel floor plate is produced by Alan Wood Steel Company by a patented process in which an abrasive—just like the kind used in grinding wheels—is embedded to a controlled depth. It becomes an integral part of a tough steel plate.

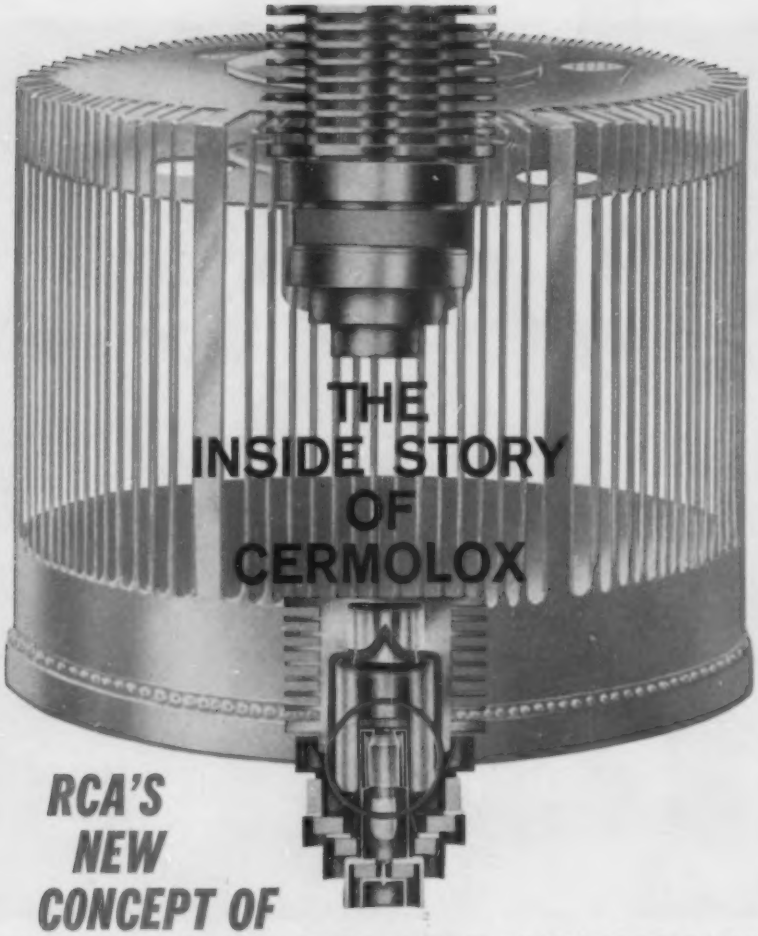
A. W. ALGRIP can be used as independent flooring . . . or as flooring overlay, on level or inclined surfaces. Put your plant on a safe footing, with A. W. ALGRIP . . . approved for Safety by Underwriters' Laboratories. Write for Bulletin **AL-S4**.

ALAN WOOD STEEL COMPANY

Conshohocken, Pa. • STEEL PRODUCERS WITH SERVICE IN MIND

DISTRICT OFFICES AND REPRESENTATIVES: Philadelphia • New York • Los Angeles • Boston • Atlanta Cincinnati • Cleveland • Detroit • Houston • Pittsburgh • Richmond • St. Paul • San Francisco • Seattle Montreal, Toronto and Vancouver, Canada—A. C. Leslie & Co., Ltd.

For more facts circle 622 on Reply Card



RCA'S NEW CONCEPT OF UHF BEAM POWER TUBE TECHNOLOGY

This unique beam power tube grid, made by a special process in which two coaxial metal thimbles are simultaneously broached by electrical discharge, provides a new range of capability for your critical UHF applications.

Perfect Grid Alignment...Simultaneous electrical broaching assures perfectly aligned grid wires for maximum electrical efficiency, high power output, minimum screen current.

Exceptional Strength and Rigidity...One-piece grid structures eliminate most internal stresses of welded assemblies and have far greater strength and rigidity.

Special RCA Ceramic-Metal Construction...Cermolox tubes embody exclusive RCA advances in ceramic-metal bonding; bond is as strong as the ceramic itself! Means superior insulation, low rf loss, compact size, unexcelled high temperature operation.

NET RESULT: A compact, sturdy, high-power UHF tube ideally suited for CW or pulse operation in a resonant cavity or a parallel-line circuit. See your Authorized RCA Industrial Tube Distributor for full information. RCA Electron Tube Division, Harrison, N. J.

TYPES FOR CW APPLICATIONS—CLASS C SERVICE

RCA Type	Cooling Method*	Filament or Heater Volt/Amperes	Maximum DC Input Watts	Typical Operation: Frequency MC	Typical Operation: Approx. Power Output Watts
A-2545-A	FA	8/80	28,000	400	10,000
A-2562-A	C	12.6/5	52.5	3,000	3.2
A-2670	C	6.3/1.0	52.5	3,000	3.3
6816	FA	6.3/2.1	180	1,215	40
6864	FA	26.5/0.52	180	1,215	40
7213	FA	5.5/17.5	2,500	600	1,350
7457 Ruggedized	FA	6.3/3	180	1,215	40
7650 Ruggedized	FA	6.3/7.5	1,000	1,215	450
7842 Ruggedized	C	6.3/3	180	1,215	40
7843	C	26.5/0.52	180	1,215	40
7844	C	6.3/2.1	180	1,215	40

*FA = Forced Air; C = Conduction
Prefix "A" designates developmental type

TYPES FOR PULSE APPLICATIONS

RCA Type	Filament or Heater Volts/Amperes	Pulse Duration (μs) / Interval (μs)	Typical Operation: Frequency MC	Typical Operation: Duty Factor	Typical Operation: Approx. Useful Power Output at Peak of Pulse KW
7214	5.5/17.5	10/1000	1,215	0.01	65
7649 Ruggedized	6.3/3	10/1000	1,215	0.01	4.5
7651 Ruggedized	6.3/7.5	10/1000	1,215	0.01	30
A-2561-A	22/12	10/1000	300	0.005	300

The Most Trusted Name in Electronics
RADIO CORPORATION OF AMERICA

For more facts circle 623 on Reply Card

PLANT ENGINEERING EQUIPMENT

(Begins on page 164)

consistency for use as a trowel coating and is directly applied from container. Because of its workability, high strength and good adhesion, it can be applied to smooth metal plates that are directly overhead, company notes. It can also be used for laying fire clay brick and super duty brick when thinned with water to proper working consistency, for shallow, cold patching of refractory masonry, and for coating inside of duct linings subjected to flue dust abrasion. Johns-Manville Corp.

▲ For details, circle 57 on Post Card

BIG MOLDED TANK of chemically inert polyethylene

Designed for non-contaminating mixing and storage of a broad range of liquids, slurries and powders in the chemical industry, this one-piece 350-gal polyethylene tank offers easy cleaning, long service life, light weight and

resistance to most concentrated acids. According to announcement, this chemically inert tank has wall thicknesses of only 5/16 in., yet is self-supporting and non-distorting even when filled. It measures 46 in. wide, 52 in. high and has fabricated polyethylene cover. American Agile Corp.

▲ For details, circle 58 on Post Card

FLOOR RESURFACER is do-it-yourself epoxy material

Tripoxy is a cold-process epoxy type resurfacing and patching material for concrete, wood and metal floors. Tests are reported to show it several times stronger and more durable than heavy duty concrete. Other advantages announced are quick, permanent adhesion, high resistance to chemicals, permanent color, rapid curing and easy application. Composed of an epoxy res-

Why you can be sure...

Celanese Cellulubes are the best functional fluids you can use

There are four practical reasons behind our claim that *you just can't buy better fire-resistant hydraulic fluids or air compressor lubricants than Celanese Cellulubes.*

1

BASIC PRODUCER—Celanese was the *first* to produce phosphate esters . . . and is the *only* producer currently marketing a series of industrial phosphate ester lubricants. Experience has demonstrated that we now have one of the best equipped plants in the country.

2

APPLICATION ENGINEERING—Our files contain facts about hundreds of successful Cellulube applications in many industries. Celanese engineers have the experience and interest to help you make the most of these functional fluids.

3

QUALITY CONTROL—Celanese zealously guards the quality of Cellulubes by a system of constant checks and controls. Physical and chemical properties are strictly maintained within exacting limits to assure you of optimum performance for fire-resistance and lubrication. What's more, Cellulubes have passed the most rigorous tests that the military and some of America's largest companies could devise.

4

TECHNICAL ASSISTANCE—Our technical staff provides assistance to see that the changeover from conventional fluids to Cellulubes is made as quickly and easily as possible. In many cases, our salesmen provide all necessary conversion know-how.

Fire-resistant Cellulubes are available in *six* controlled viscosities. Not only are they outstanding for the prevention of fire and explosion, but they give overall wear protection comparable to premium petroleum oils. Get the complete facts by using the coupon below. Celanese® Cellulube®

Celanese Chemical Company, Dept. 585-C
180 Madison Avenue, New York 16, N. Y.

Please rush me a copy of your manual on Cellulubes as
☐ hydraulic fluids ☐ synthetic lubricants

Name_____ Title_____

Company_____

Address_____

City_____ Zone_____ State_____

Celanese CHEMICALS

FM Factory Mutual-Approved (Cellulubes 150 and 220)

Bureau of Mines-Approved #30-2

Celanese Chemical Company is a Division of Celanese Corporation of America.
Canadian Affiliate:
Canadian Chemical Company Limited, Montreal, Toronto, Vancouver.
Export Sales:
Amcel Co., Inc., and Pan Amcel Co., Inc., 180 Madison Ave., New York 16.

For more facts circle 624 on Reply Card

Take the legwork out of liquid measurement

Here's practical liquid measuring—the modern way... without roaming all over the lot! Liquidometer Gauges let you inventory distantly stored liquids at a glance.

Completely automatic Liquidometer Gauges can be located as far as 250 feet from tanks. Think what this centralized system can mean in man-hours saved—let alone the additional safety of personnel who no longer have to trudge to, or tamper with, hard-to-get-at tanks.

Simple to install, and requiring no maintenance, Liquidometer Gauges measure virtually all liquids conveniently, continuously, and correctly. There's a type available for practically every liquid measuring application.

For complete details, write

LIQUIDOMETER INSTRUMENTS

THE LIQUIDOMETER CORP.

Dept. B, LONG ISLAND CITY 1, NEW YORK

For more facts circle 625 on Reply Card

PLANT ENGINEERING EQUIPMENT

(Begins on page 164)

in binder, pigmented hardener and sand aggregate, Tripoxy can be applied by the plant maintenance crew. A covering only ¼ in. thick is recommended and it may be troweled smooth or rough. Tripoxy may be walked on in 4 to 8 hr, says manufacturer; it's ready for medium heavy traffic within 15 hr, heaviest traffic in a few days. Masury-Young Co.

▲ For details, circle 59 on Post Card

SEALANT for repair of transformer oil leaks

Oyltite-Stik is offered for emergency sealing of leaks through cracks or pinholes in welds or joints of oil-immersed transformers. It can repair many such leaks while the transformer is still in

service, states manufacturer; it is not affected by temperature changes and remains plastic, expanding and contracting with the part repaired. Similar to a stiff putty, the dark gray sealant comes in sticks, about 4 in. long. You rub Oyltite-Stik over the leak several times to force the material into the leak. Westinghouse Electric Corp.

▲ For details, circle 60 on Post Card

It's easy to obtain product data with the postage-free Reader Service Card provided on pages 223-224. Use them for information on advertised products, too. Just circle the key number appearing at bottom of the ad.

TWO-WHEEL HAND TRUCK is collapsible, lightweight

Tota-Ton is described as a completely collapsible, aluminum two-wheel hand truck weighing less than 10 lb and

MICRO SWITCH Precision Switches

Neon Check Light Signals Operating Position!

New "301LS" is another in MICRO's line of "Plug-in Limit" Switches. This model contains 2 basic switches, each with a normally open and normally closed circuit.

The new "LS" Limit Switch has a translucent plastic insert and enclosed neon light that tell at a glance whether the switch is functioning. Perfect answer for checking switches that must be located in inaccessible or poorly lighted areas, or where it is important to be able to check a large number of limit switches on a production line in minimum time. The new switch is an addition to MICRO's line of compact, high capacity "LS" limit switches.

New "301LS" has two basic switches which are operated when the actuating lever is moved clockwise or counterclockwise. Internal adjustments are easily made to provide sequence operation of the two enclosed switches. Sequence control is useful on tool slides to 1) switch from rapid traverse to feed rate and then 2) with the second switch, return the tool to the original position. Sequence control is also used as a positive limit stop where machine damage could occur by a fault in the first switching circuit. See the Yellow Pages for your nearby MICRO SWITCH distributor or write for Data Sheet 187.

MICRO SWITCH . . . FREEPORT, ILLINOIS
A division of Honeywell
In Canada: Honeywell Controls, Limited, Toronto 17, Ontario

Honeywell
MICRO SWITCH Precision Switches
For more facts circle 626 on Reply Card

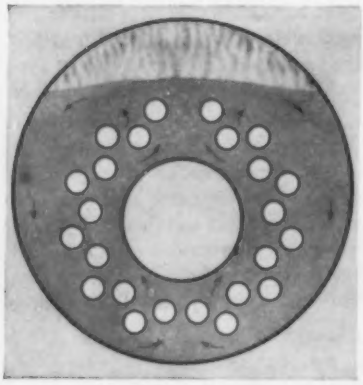
"... it is properly rated as one of the most efficient boilers on the market."

Continental

2-PASS

AUTOMATIC BOILERS

EFFICIENCY of the 2-Pass Continental Boiler means that you get guaranteed 80% minimum efficiency with oil and equivalent with gas fuel. With its simplified 2-Pass design, the Continental delivers sustained high efficiency for the life of the boiler. Stack temperature is guaranteed not to exceed 125°F above boiler water temperature.



BALANCED HEAT DISTRIBUTION. *An important reason for Continental high efficiency and long service life is equal spacing of return tubes around centrally located furnace. Large areas between tubes, furnace and boiler shell provide rapid, unimpeded water circulation, faster heating and unrestricted steam release. No Continental Boiler has ever suffered damage or failed due to "thermal shock."*

Write for details of new boiler Leasing Plan and Bulletin BE-400.

CONTINENTAL BOILER Division
BOILER ENGINEERING & SUPPLY CO., Inc.
Phoenixville, Pennsylvania
Nationwide Sales and Service in Principal Cities

For more facts circle 627 on Reply Card

PLANT ENGINEERING EQUIPMENT

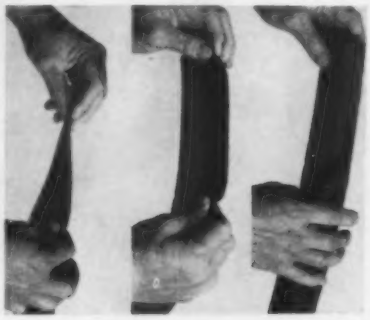
(Begins on page 164)

capable of lifting 500 lb. Made from extruded aluminum (Reynolds Metals Co.), truck folds up quickly into a compact 6-by-36 in. unit. Erected it has a 14-in. base annd an adjustable 57-in. handle. Sturgis Mfg. Co.

For details circle 61 on Post Card

JOINT SEALER has high expansion recovery

Sealfastic—shown compressed and expanded—is announced as a waterproof, pre-molded concrete joint sealer with 100 per cent recovery up to 1 in. Company says it may be slipped into joints

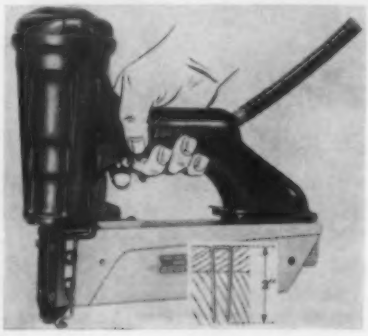


as thin as ⅛ in. sawn joints, straight or curved, will last indefinitely, and is fuel resistant. It consists of 1-in. batts of polyurethane foam, impregnated with choice of binders. A hand-operated flattening tool installs it. National Expansion Joint Co.

For details, circle 62 on Post Card

STAPLE NAILER features greater power drive

Duo-Fast S-763 Staple Nailer is claimed to offer greater power drive, improved safety cap and more positive magazine lock, for crating and packaging, expendable skids, boxes, furniture and wood frame assemblies. It is designed to drive 16-gage, galvanized



NOW...select
flexible couplings by SHAFT SIZES

new
shaft-rated
DIAMOND *hi-Cap* *™

COUPLINGS
give you

- **lower cost**
- **bearing and shaft protection**
- **quick, easy selection and installation**

***Hi-Cap* means HIGH CAPACITY**
All working parts are heat treated steel, and hardened to provide greater resistance to wear, longer service life.

◆ DIAMOND
Hi-Cap couplings are available in Finished-Bore and Taper-Lock to accommodate any shaft diameter combination from ⅛" to 6½". New *Hi-Cap* Bulletin No. 1060-C gives construction details, specifications and prices. WRITE TODAY!

DIAMOND CHAIN COMPANY, INC.
A Subsidiary of American Steel Foundries
Dept. 614, 402 Kentucky Ave., Indianapolis 7, Indiana
Offices and Distributors in All Principal Cities

DIAMOND ROLLER CHAINS

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Diamond Chain Company, Inc.

* The trademark *Hi-Cap* is the property of Diamond Chain Company, Inc.

For more facts circle 628 on Reply Card

PLANT ENGINEERING EQUIPMENT

(Begins on page 164)

staples, 1½ to 2 in. long at air pressures of 60 to 100 psi. Fastener Corp.
For details, circle 63 on Post Card

ULTRASONIC GENERATOR fits many applications

Compact and flexible, the Inson 100 PW Generator has connections for any of 10 output impedances, which may

be selected from a broad range to match impedance requirements. Any nominal frequencies from 10 to 100 kc or greater may be specified. This wide range of output values suits this 100-w generator to ultrasonic welding, soldering, splicing and sealing of metals and plastics, ultrasonic cleaning, ultrasonic drilling, and use with processing cylinders or other specialized transducers. Power output is continuously variable from zero to full power. Frequency range of standard unit is 35-45 kc and impedances are 17.5 to 20,000 ohms. It costs under $700. International Ultrasonics, Inc.
For details, circle 64 on Post Card

FAST FLOW RATE FILTER aid for viscous material

Celite 560 is announced as a diatomite filter aid having a flow rate nearly double that of previous materials. It is claimed to enable filtration of extremely viscous materials that could not previously be filtered with filter aids because of too low a permeability. Johns-Manville Corp.
For details, circle 65 on Post Card

LEVELING MOUNT offers machine layout flexibility

For attachment to any machine, the Bolt-On Wedgmount serves as both vibration mount and leveling device.

One sturdy bolt secures it, making it an integral part of the machine—when the machine is moved, mount moves too. Clark-Cutler-McDermott Co.
For details, circle 66 on Post Card

MEMO KIT folds up for note-taking away from office

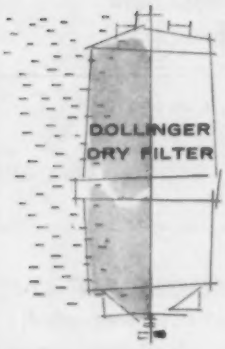
You can fold this desk memo kit up and take it with you for note-taking away from office—in taxi, plane, during conferences. Vinyl-covered book

holds a legal pad on one side and has a pocket on the other side for loose notes and correspondence. Kit may be gold stamped with individual or

. . . in the chemical treatment of your WATER—STEAM—FUEL. For over 70 years Western's special formulas and individual technical service have been controlling scale, corrosion, foaming, algae, sludge, soot, and related operating problems. Ask for the brochures that apply to your own needs.

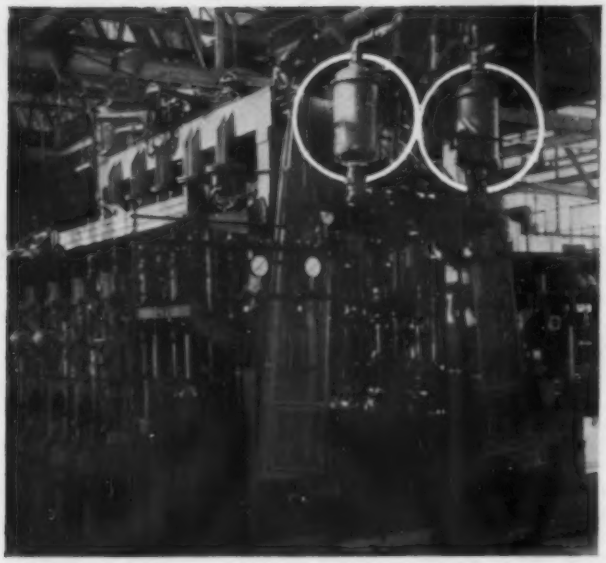
WESTERN CHEMICAL COMPANY
714 Washington St., Kansas City 5, Mo.

For more facts circle 629 on Reply Card



SPECIALISTS
FOR 39 YEARS

ELIMINATE DIRT FROM BOTTLE-FORMING OPERATION



Two Staynew Filters prevent air-borne dust and dirt from being blown into molten glass on bottle-forming machines of the Hartford-Empire Company Division of Emhart Mfg. Co., Hartford, Connecticut.

DOLLINGER STAYNEW FILTERS keep compressed air lines clean, help Hartford-Empire consistently produce a clearer, more perfect bottle with fewer rejects. Applied to air lines of bottle-forming machines, the filters remove moisture, dirt and dust particles down to five microns . . . or less than 0.0002 inches!

MICRO-FILTERING LIKE THIS is only part of the story. Hartford-Empire finds that Staynew Pipeline Filters offer the largest active filtering area in relation to the space occupied; they maintain low velocity and resistance to flow, thus helping to keep proper line pressures and save horsepower. Staynew Filters also eliminate the need for frequent cleaning; when cleaning is necessary, simple opening of swing bolts permits removal of filter element without breaking pipe connections.

DESIGNED FOR ANY TYPE OF SERVICE, Staynew Filters may be the answer to your filtration problem. Find out more information by talking to your Dollinger representative, or write for Bulletin 200. Dollinger Corporation, 55 Centre Park, Rochester 3, New York.

STAYNEW FILTERS

DOLLINGER

LIQUID FILTERS • PIPE LINE FILTERS • INTAKE FILTERS • HYDRAULIC FILTERS • ELECTROSTATIC FILTERS • MIST COLLECTORS • DRY PANEL FILTERS • SPECIAL DESIGN FILTERS • VISCOUS PANEL FILTERS • LOW PRESSURE FILTERS • HIGH PRESSURE FILTERS • AUTOMATIC VENTILATION FILTERS • NATURAL GAS FILTERS • SILENCER FILTERS

For more facts circle 630 on Reply Card

...discriminating buyers choose

FEEDRAIL

Crane & Hoist Electrification Systems

1. **Electrical Safety**—Heavy gauge steel housing encloses copper bus bars, track-supported trolleys with positive polarization and uniform contact pressure, and every other provision making an electrical system safe and fool-proof is incorporated.

2. **Personnel Safety**—Metal enclosure protects plant and maintenance personnel. No dangerous bar conductors and accident-causing broken wires, trailing or strung cables.

3. **Dependability** – Rugged, precise construction, pays dividends in power continuity and maintenance—keeps cranes and hoists rolling!

4. **Adaptability**—Prefabricated runs may be of any length, straight or curved, with turntables, slide or tongue switches. Readily adaptable to suit changed conditions, every part re-usable.

5. **Compactness**—Single metal housing occupies less than half the space of open conductors or sheathed bars. Looks neat, too!

6. **Easy Maintenance**—Replacement of parts is negligible. Any part can be replaced without interfering with the rest of the installation.

7. **Life-Time Use**—Never becomes obsolete! Assures power for the life of the crane or hoist. Outlasts other types of electrification.

8. **Low Installation Cost**—Nothing left to do on the job site but to connect units together—fast—because everything has been engineered to fit installation requirements. No special tools!

Information for you: Bulletins are available on Feedrail 60 Ampere Systems (90 Ampere Intermittent Service); 100 Ampere Systems (150 Ampere Intermittent Service); and Heavy Duty Systems of 225, 375 and 500 Amperes. See your local Electrical Distributor or write Feedrail, Department P-4.

Never Becomes Obsolete

ELECTRIC FEEDRAIL®

FEEDRAIL CORPORATION

Subsidiary of Russell & Stoll Company, Inc.

125 BARCLAY STREET • NEW YORK 7, N. Y.

SPECIALLY QUALIFIED REPRESENTATIVES IN PRINCIPAL CITIES

For more facts circle 631 on Reply Card

PLANT ENGINEERING EQUIPMENT

(Begins on page 164)

company name and trademark. Individual kits cost around $4.00. Cobb Shinn Services.

▲ For details, circle 67 on Post Card

FLEXIBLE CANVAS GLOVES are plastic impregnated

Cromac Gloves are claimed to outwear canvas gloves several times, to be more snag resistant, and to retain high finger dexterity. Their purchase price is higher, says company, but they cost less per hour of glove wear service. They're made from a napped cloth

impregnated on one side with polyvinyl chloride to resist wear and provide a firm gripping surface. Cromac Gloves can be used where canvas gloves are usually worn and in high-wear applications where expensive gloves are not justified or where more finger dexterity is needed. Although not moisture- or oil-repellent, they show less absorption than untreated cloth gloves, says manufacturer; they shouldn't be dry cleaned but may be washed repeatedly. Jomac Inc.

▲ For details, circle 68 on Post Card

DOOR INTERLOCKS for checking electrical equipment

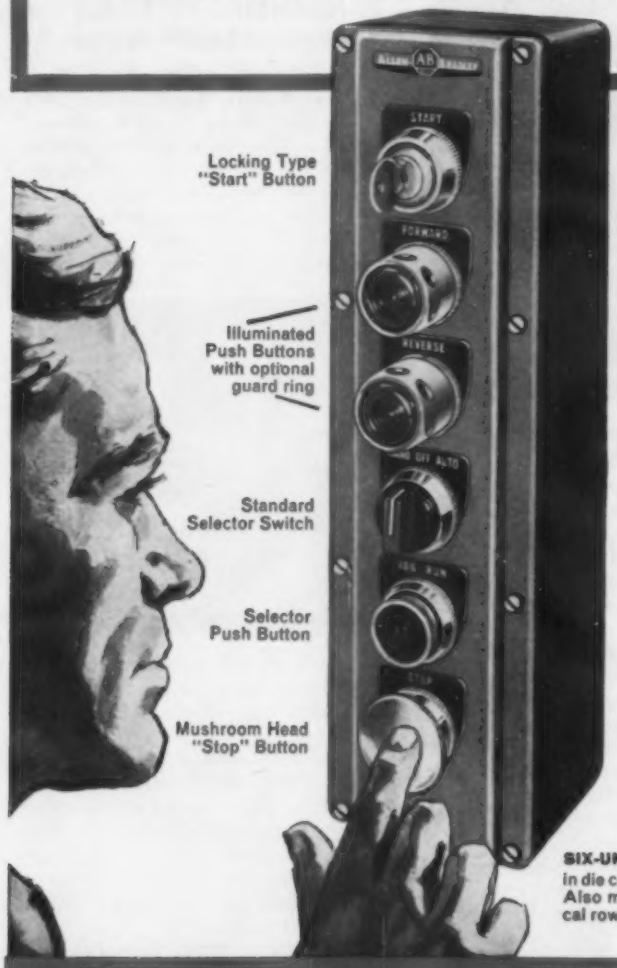
These three door interlocks feature a maintained-contact actuator position for checking hazardous electrical equipment. They are designed to automatically cut power to electrical components when service door is opened and turn it back on when door is closed. For checking equipment without using jumpers or cheaters, the actuating plunger is pulled to maintained-contact position to keep power on. Company says this technique eliminates "wiring around" the interlock, with the possibility of jumper being

BE SURE YOU GET

Quality Appearance Quality Operation

Specify Allen-Bradley's line of ***OILTIGHT CONTROL STATIONS***

Allen-Bradley oiltight units and stations harmonize with the trim lines of modern machine tools —they look as if they were a part of the machine. Also, from the wide selection of control units, you'll be able to satisfy every operating requirement. A-B control units are positively oiltight—impossible for oils and cutting fluids to foul the contacts. And the silver contacts assure reliable operation. The rugged construction and generous wiring room of all A-B stations are valued by the installation engineer. Insist on Allen-Bradley pilot control units and stations—you can't make a mistake! Send for Publication 6090.



FLUSH HEAD
push button, also made with extended head.

WING LEVER PUSH BUTTON
Combines push button and selector switch.

PUSH-TO-TEST PILOT LIGHT
Six different color lenses available.

4-WAY SELECTOR SWITCH
Also furnished for 2-way operation.

PILOT LIGHT
Transformer or full voltage types.

DOUBLE CIRCUIT
Has 2 N.O. or 2 N.C. sets of contacts.

PILOT LIGHT CLUSTER
Four lights of different colors in one unit.

SELECTOR SWITCH
With coin slot operator. Other operators available.

CONVENIENCE RECEPTACLE
For plugging in work light or small tools.

SPECIAL CONTROL CONSOLES
can be furnished to meet your exact operating requirements.

SIX-UNIT CONTROL STATION
In die cast aluminum housing. Also made with up to 4 vertical rows with 4 units per row.

ALLEN-BRADLEY

Member of NEMA

Allen-Bradley Co., 1317 S. First St., Milwaukee 4, Wis. In Canada: Allen-Bradley Canada Ltd., Galt, Ontario

QUALITY MOTOR CONTROL

For more facts circle 632 on Reply Card

Specify BLAW-KNOX Electroforged® Steel Grating

A primary function of open flooring is to admit light and air to areas above and below its surface . . . to provide safer, more comfortable working conditions. Blaw-Knox Electroforged Steel Grating is designed to provide maximum open area.

Load requirements establish equal bearing bar dimensions for all types of grating, in equal service. Because it is Electroforged, Blaw-Knox grating can get maximum strength from crossbars only ¼ inch square. This means less obstruction to light and air, and safer, more comfortable working conditions above and below.

Visibility is only one way Electroforged grating increases safety. Sure footing is provided by the non-slip, twisted crossbar and a choice of either square, or serrated bearing bars. Electroforged grating is self cleaning, too. There are no joints or crevices to collect dirt and grease.

Electroforged grating also is available in other materials such as Monel, Cor-ten and aluminum. Write for Bulletin 2581 for further information. Blaw-Knox Company, Pittsburgh 38, Pa.

Blaw-Knox Equipment Division

BLAW-KNOX
GRATING

For more facts circle 633 on Reply Card

PLANT ENGINEERING EQUIPMENT

(Begins on page 164)

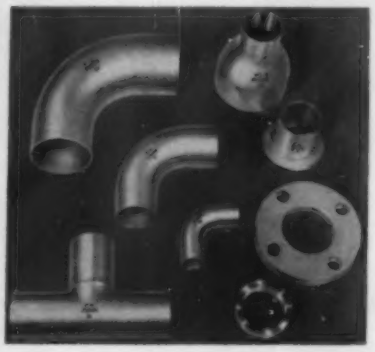
forgotten, thereby defeating the purpose of the interlock. When the door is closed, the actuator returns to normal position.

Two series offered — 22AC and 23AC—differ only in the shape of mounting bracket and location of mounting holes. The 24AC model, which controls two separate circuits at the same time, uses two switches. Switches are rated for 10 amp at 125 or 250 v a-c; ½ amp at 125 d-c and ¼ amp at 250 v d-c; ½ hp at 250 v a-c. Micro Switch, Div., Minneapolis-Honeywell Regulator Co.

▲ For details, circle 69 on Post Card

TANGENTIAL FITTINGS can be joined easily to pipe

Pypon Fittings, designed for nominal temperature, low pressure process piping, can be joined to pipe using equipment normally available in any shop. Line includes elbows, returns, tees, caps, stub ends and reducers in stainless steel or aluminum, ½-through 4-in. pipe sizes, Schedule 5S and 10S. Fittings are

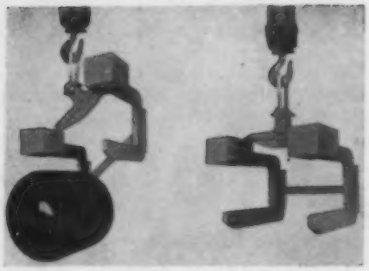


supplied with long tangents which permits joining them to pipe by rolled-in flanged assemblies, fillet welding, soft soldering, silver brazing, or butt welding. Company says their use, with lightweight or featherweight pipe instead of Schedule 40 pipe, provides greater flow area, reduces weight and effects savings in material cost. Bulletin P59 gives information on these tangential fittings. Flowline Corp.

▲ For details, circle 70 on Post Card

DOUBLE-ARM C HOOK for coil handling service

This double-arm articulated C hook allows crane operator to pick two coils at a time on a continuous coil line, or



to handle a single coil to fill available floor space. Articulated design of double hook unit permits empty arm to elevate upward out of the way when only one coil is lifted, enabling operator to "spot" a single coil in narrow space without removing double-arm hook from crane. Cullen-Friestedt Co.

For details, circle 71 on Post Card

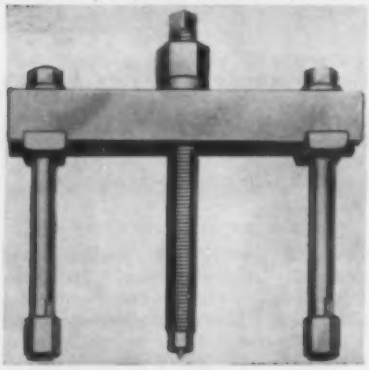
EMERGENCY LIGHTING UNIT operates automatically

Light Warden Chargomatic 88 contains no manually operated switches or timers—it plugs into a standard 115-v 60-cycle outlet. Normal power maintains battery charge, company explains, and when power fails, loss of power throws a relay to turn on the emergency lights immediately. The unit is also available with three-conductor cord and plug or Conduit for permanent a-c connection. It has two flood heads and can support up to five lights in operation. Battery is a 6-v, 105-amp/hr lead acid, glass jar type with visible hydrometer balls. Electric Cord Co.

For details, circle 72 on Post Card

PUSH-PULLER LEGS for use in confined areas

This set of 4¾ in. long legs is designed to allow easy application of company's manually operated push puller, No. 927,



in confined areas. The set weighs only 1 lb. Leg ends are threaded for adapting various attachments to specific jobs. Owatonna Tool Co.

For details, circle 73 on Post Card

at CHRYSLER...

REMOVING CHIPS FROM WATER PUMP PASSAGE HOLES AFTER MACHINING. CHRYSLER ENGINE PLANT, DETROIT, MICH.

SPENCER
VACUUM CLEANERS

• GUARD QUALITY
• CUT ASSEMBLY COSTS

Operations performed here by Spencer vacuum cleaners include:

• Removing chips during assembly of head to block • Cleaning oil filter pad inlet passages • Automatically cleaning bearing cap assembly on block • Automatically removing core sand from engine block castings • Cleaning floors and conveyors.

In large plant or small... for maintenance or production needs... portable units or installed systems... whatever your requirements, it will pay to check with SPENCER.

REQUEST CATALOG #155B ON "INDUSTRIAL VACUUM"

The SPENCER TURBINE COMPANY
HARTFORD 6 CONNECTICUT

For more facts circle 634 on Reply Card

Industrial Plant Construction

(Continued from page 156)

the supervision of company's Lawson Milk Co. division. Work on the new addition will be completed by the end of 1961 at a cost of $1.3 million.

Enid, Okla.—Champlin Oil & Refining Company has awarded a contract to the Fluor Corp., Ltd., 2500 S. Atlantic Boulevard, Los Angeles, Calif., for the design, engineering, purchasing and construction of a 4000 barrel a day coker installation at company's refinery located here. Design of the project is already under way with no date set as yet for the start of actual construction. Plant when completed will represent an investment of approximately $1.5 million.

Girard Point, Pa.—Gulf Oil Corporation plans to build a new multi-million dollar benzene plant at refinery located here. This will be in addition to new oxo-alcohol plant which was completed recently. Other plans for expansion of the petrochemical facilities are expected to bring total investment at this location to more than $20 million.

Philadelphia, Pa.—Fairmount Motors Products Co., Inc., 1901 N. 20th St., has acquired a large industrial site at 18th and Indiana Ave. where it will construct a one-story building of about 50,000 sq ft in an expansion of its facilities here. Company manufactures and distributes automotive specialties and has its headquarters here; operates plants in Kansas City, Mo. and Toronto.

Chocolate Bayou, Texas—Monsanto Chemical Co., 1700 S. Second St., St. Louis, Mo., has authorized plans for the erection of a huge chemical complex here, for the manufacture of ethylene, napthalene, benzene, and other chemicals from petroleum. Chief part of the venture will be a 500 million lb a year plant to make ethylene, key raw material in polyethylene plastic. Other production units will turn out 42 million gallons of benzene and 50 million lb of napthalene annually, plus quantities of propylene, cumene, phenol, acetone and ethyl benzene. It is believed that the cost of this installation will run as high as $75 million.

Corpus Christi, Texas—Suntide Refining Company, a wholly owned subsidiary of Sunray Midcontinent Oil Co., of Tulsa, Okla., plans to construct an ethyl benzene separation unit at company's refinery located here. Plant will be designed for an annual capacity of 30 million lb and will go on stream this year. Badger Manufacturing Co., Cambridge, Mass., has been awarded the contract for process design, engineering and construction of the separation unit.

Houston, Texas—Tennessee Gas Transmission Co. plans to construct a major petrochemical plant on its Houston Ship Channel property acquired for the purpose. In line with this, the company and Cary Chemicals, Inc., of East Brunswick, N. J., announced a long-term production and marketing association. Company stated that its new plant, in which Cary is expected to have an equity participation, will get under way soon with completion scheduled for late 1962. New facility will be the first development on the company's 794-acre site on the Houston Ship Channel.

Hoquiam, Wash.—Rayonier, Inc., 161 E. 42nd St., New York, N. Y., has authorized a major addition to company plant located here. Plans call for a large steel, concrete pulp bleaching plant addition. Work will begin soon on the new facility which is scheduled for completion by mid-1962. Sandwell International, Ltd., 1512 Alberni St., Vancouver, B. C., is consulting engineer of the project. Cost of the new installation is reported to be about $2.4 million.

Kalama, Wash.—Dow Chemical Company, 1000 Main St., Midland, Mich., has announced plans for the construction of a large phenol plant on large tract of land owned by the company at this location. Facility is scheduled to go on stream by the summer of 1962. Plant will have a capacity of 36 million lb of the product per year. Company has let contract to the Hoffman Construction Company, Portland, Ore., who will supervise construction details.

Hydraulic and pneumatic lines are quickly and easily connected with Hansen Two-Way Shut-Off Couplings. No tools required.

When coupling is disconnected, valves contact valve seats in both Socket and Plug to provide instant and positive seal of fluid in both ends of line. Coupling does not depend upon line pressure to seal either end of line.

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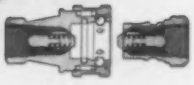

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Westinghouse Lamp Division, Westinghouse Electric Corporation, Bloomfield, New Jersey

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NEW BOOKS

for the plant engineer

A Guide to Civil Engineering

CIVIL ENGINEERING HANDBOOK, editor-in-chief, L. C. Urquhart. Size 9¼ by 6¼ in.; 1184 pages including index; illustrated; cloth bound. Published by McGraw-Hill Book Co., 330 W. 42nd St., New York 36, N. Y. Price $17.50.

THIS PUBLICATION, the fourth edition of the handbook, brings the principles and methods of civil engineering up to date. Written by thirteen of the country's authorities in their respective fields, the book covers the basic phases of the science of civil engineering.

Although the engineering of railways, highways and airports may not be of direct interest to plant engineers, the handbook presentation of materials, hydraulics, stresses in structures, steel design, etc., is of interest to them.

Each chapter of the handbook details the rules, theory and working methods of the several engineering specialties covered, and provides engineering pointers for each subject.

Cement and concrete, for example, is covered in detail—from the basic definitions and mixes to the formulas used in reinforced concrete design.

Other engineering fields included in the text are sewerage and sewage disposal, soil mechanics, water supply and treatment, and an excellent chapter on principles and methods of surveying.

Tips on Management

SMALL PLANT MANAGEMENT. Prepared under auspices of the ASME Management Div., size 9 by 6 in. approx.; over 560 pp including index; cloth bound. Available from McGraw-Hill Book Company, Inc., 330 West 42nd St., New York 36, N.Y., Price $10.50.

THIS REVISED second edition of a widely-used book describes and illustrates modern concepts and improved procedures of planning, organizing, operating and supervising, especially suited for use in small plants.

Among the topics discussed are: small plant financing and banking; supervising and controlling the small plant; how to buy best facilities and materials; how to fulfill the legal requirements; how to make savings and use profits; the general outlook for small plants in the United States; and quality control in the small business.

Reinforcing Steels Tested

COMPARISON TEST OF REINFORCING STEELS—WT 1473. Size 10½ by 8 in.; 108 pp; illustrated; paper bound. Available from the Office of Technical Services, Department of Commerce, Washington 25, D.C. Price $2.25.

THIS REPORT pertaining to project 34.2 presents information on hard and intermediate grade steel being used as reinforcement of concrete slabs subjected to nuclear blast loading. Tests on which this report is based were made in 1957.

The introductory chapter contains some background discussion on reinforcing bars with comment on a controversial passage which appeared in another publication. The ensuing chapter goes into the design considerations for the project and also includes brief passages on instrumentation.

Results of the tests are treated in a separate section. This is followed by a discussion chapter taking in such items as early deflection-time records, steel strain at concrete failure, static slab material properties and dynamic slab response, and strength variability of rail steel. Conclusions and recommendations are also included in the report. The appendices contain experimental data, material on test slab design and a post test analysis of project 34.2 slabs.

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This compact Package Air Preheater is being installed on a 150,000 lb/hr boiler at Olin Mathieson Chemical Corp.'s Brandenburg, Kentucky, petrochemical plant. When in operation it will recover enough heat from the boiler exhaust to increase efficiency of the boiler between 8% and 9%.

OLIN MATHIESON RECOVERS 360°F FROM BOILER EXHAUST WITH 11½′ x 11′ x 8′ PREASSEMBLED LJUNGSTROM® PACKAGE AIR PREHEATER

Olin Mathieson specified a Ljungstrom Package Air Preheater because it saves space as well as fuel. Mathieson's Ljungstrom occupies only about 1000 cubic feet, but cuts boiler exhaust temperature from 680°F to 320°F — puts 360° of heat back to work in the boiler.

The compact preassembled Package Air Preheater is ready to run when it's delivered—just connect to the power line and ducts, and it's on-stream. You make big savings on installation because there's no on-the-spot erection.

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* * *

Herbert L. Norton came to Du Pont's Finishes Division in 1939, having studied chemical engineering at the Georgia School of Technology. As he added experience, increased responsibilities kept pace. Currently, Herb is Southeastern District Manager, Industrial Maintenance Sales. His background includes problem-solving in such areas of industry as textile, paper, petroleum, food, marine and public utilities.

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BULLETINS

(Begins on page 21)

Ductile Iron Valves—General information and specifications on ductile iron valves and fittings are presented in 12-pp Catalog 1. Includes comparison of physical and chemical properties and engineering specifications. Stockham Valves & Fittings.
▲ For a copy, circle 144 on Post Card

Cast Steel Valves—High-pressure, high-temperature cast steel valves are described in this 6-pp Pressure-Seal bulletin. Dimensional data and material specifications are included. Walworth Co.
▲ For a copy, circle 145 on Post Card

Pinch Valves—Construction features, and advantages of Massco-Grigsby pinch valves are explained and illustrated in 14-pp Catalog 609. Provides sleeve service recommendations and specifications and closing mechanism specifications for manual, motorized and hydraulic types. Also introduces Hydral-60, a pinch valve system. Mine and Smelter Supply Co.
▲ For a copy, circle 146 on Post Card

Safety Shutoff Valves—Featured in 12-pp Supplemental Bulletin 22 are safety shutoff valves and supervising gas cocks for two-way plant protection. Capacity tables, dimensions and general specifications are included. North American Mfg. Co.
▲ For a copy, circle 147 on Post Card

Valve Sizing Charts—Bulletin JSC-1 shows how to size company's sliding gate regulators and control valves. Simplified charts cover steam, liquid and gas service, and cross-reference method of compiling make slide rules and formulas unnecessary. Technical data (applying to all makes of valves tells how to adjust sizing for variations in pressure, temperature, viscosity or specific gravity. OPW-Jordan Corp.
▲ For a copy, circle 148 on Post Card

Strainer Selection—Twelve-pp Catalog 6008, on self-cleaning strainers for steam, air, gas and liquids, details over 600 standard strainers and shows selection of body materials, end connections, pressure ratings and sizes. Pressure-drop and pressure-temperature limit data are provided. Leslie Co.
▲ For a copy, circle 149 on Post Card

Rotary Joints—Catalog 310-B describes rotary joints which require no lubrication, work for single flow or syphon steam service, and handle steam, water, air, oil or gas. Working pressure ratings, dimensions and installation suggestions included. Barco Mfg. Co.
▲ For a copy, circle 150 on Post Card

FILTERING

Panel Type Filters—Characteristics and applications of panel type air filters made of Dynel are described in Bulletin A1. Performance graphs, and diagram of arrangements included. Union Carbide Development Co.
▲ For a copy, circle 152 on Post Card

Vacuum Filters—Circular 1037 explains how vacuum filters work and describes two new filters—one for removing dirt and water, and one for removing oil, dirt and water. Selection details given. Wilkerson Corp.
▲ For a copy, circle 153 on Post Card

ELECTRICAL

Open Motors—Stator insulations and full-protection features of Super-Seal motors are illustrated and described in 12-pp Bulletin 05-51B9040B. Advantages and performance details are covered and typical applications illustrated. Allis-Chalmers Mfg. Co.
▲ For a copy, circle 154 on Post Card

Electric Motors—Featured in 8-pp Bulletin 2651 are a-c and d-c motors, special motors and gearmotors. Describes applications, available ratings, enclosures and modifications. The Louis Allis Co.
▲ For a copy, circle 155 on Post Card

Fhp Motors—Detailed information on fractional horsepower motors is presented in 8-pp Bulletin B-2514. Advantages and characteristics are detailed and specifications given. Reliance Electric and Engineering Co.
▲ For a copy, circle 156 on Post Card

Load Centers—Descriptions, wiring diagrams, dimensions and selector tables for circuit breaker load centers are presented in 20-pp Catalog C-200. Features and advantages of the circuit breakers are illustrated. The Bryant Electric Co.
▲ For a copy, circle 157 on Post Card

Two-High Controller—Design and operating features of the SpaceMaker controller are described by Allis-Chalmers Mfg. Co. in 8-pp Bulletin 14B9739. This lightweight controller is announced as the first two-high, drawout control in the 2000-5000 v range. Discusses lower installation costs, space saving advantages, accessibility. Allis-Chalmers Mfg. Co.
▲ For a copy, circle 158 on Post Card

Electro-Magnetic Relays—Comprehensive engineering data on electromagnetic relays is presented in this 16-pp product bulletin. Mounting data and descriptions of wide variety of enclosures is given, as well as information on various terminals. Potter & Brumfield Div., American Machine & Foundry Co.
▲ For a copy, circle 159 on Post Card

Low Voltage Equipment—Illustrated and described in 92-pp Fall, 1960 Buy Log on low voltage equipment are safety switches, tumbler switches, wireway, circuit breakers and enclosures, panelboards, switchboards, motor control centers, sectional distribution centers, busway and service entrance equipment. Includes application data and dimensions. General Electric Co.
▲ For a copy, circle 160 on Post Card

Current-Limiting Fuses—Application information on current-limiting power fuses rated 600 to 34,500 v is presented in 8-pp Bulletin GEA-7137. Includes photos, cutaway drawings and graphs showing components. General Electric Co.
▲ For a copy, circle 161 on Post Card

Electrical Testing Instruments—Twelve-pp Catalog 10-1.3 covers instruments for maintenance, installation and proof-testing of plant electrical equipment. Included are dielectric breakdown test sets from heavy duty types with a-c or d-c potentials to 150 kv, through mobile, bench and hand-carried portable models. Megohmmeters with ranges to 5,000,000 megohms are presented. Associated Research, Inc.
▲ For a copy, circle 162 on Post Card

Plug-In Bus Duct—Bulletin XL-765, 32 pp, provides technical data, dimensions, catalog information and layout procedures for a new plug-in bus duct with low voltage drop characteristics and built-in safety features. Also included are dimensional and technical data on X100 bus duct, 100-amp plug-in duct for use as lighting distribution feeder or extended panelboard. Bulldog Electric Products Div., I-T-E Circuit Breaker Co.
▲ For a copy, circle 163 on Post Card

Postage-free cards for ordering Bulletins are on facing page. You may also use the cards to order literature mentioned in the ads.

Portable Cords, Cables—Applications and advantages of portable cords and cables are detailed in 52-pp Form KW-915. Describes insulation compounds, performance insulation, and jacket compounds, as well as portable cords and cables, and includes splicing and patching data. Kaiser Aluminum & Chemical Corp.
▲ For a copy, circle 164 on Post Card

Cable Suspension System—Illustrated and described in Bulletin 161 is a cable suspension system for industrial, processing, mining and other applications. Charts on how to determine requirements are given. Perfect-Line Mfg. Corp.
▲ For a copy, circle 165 on Post Card

SAFETY, SANITATION

Fire Fighting Equipment—Interior fire fighting equipment is illustrated and described in 16-pp Form S-62FPB. Includes engineering and specification data on fire extinguishers, fire hose and extinguisher wall cabinets, hose racks, hose reels, angle valves, fire hose, nozzles, and accessory equipment. The Fyr-Fyter Co.
▲ For a copy, circle 166 on Post Card

Soap Equipment, Soaps—This 14-pp bulletin discusses long range economy of company's soaps and public preference for liquid soap. Describes types for a variety of cleansing requirements. Also illustrates and describes soap dispensing equipment, paper towels and cabinets. West Chemical Products Inc.
▲ For a copy, circle 167 on Post Card

BULLETINS

(Begins on page 21)

INSTRUMENTS, CONTROLS—

Monitoring Systems—This 8-pp booklet describes a high speed, continuous electronic system designed to monitor any condition representable by an electrical contact closure. Applications include circuit breakers, switches, sensing devices etc. Bulletin discusses system synchronization, construction features. Lynch Communication Systems, Inc.
▲ For a copy, circle 168 on Post Card

Advanced Potentiometer—Highlights of the ElectroniK potentiometer are presented in this 24-pp bulletin. Stresses performance advantages afforded by the Stranducer rebalancing element, versatility afforded modular construction and interchangeable components, and long range economy as well as lower initial cost. Three basic models—strip chart, circular chart, and circular scale—are illustrated. Also described and pictured are display, drive and case modules. Minneapolis-Honeywell Regulator Co.
▲ For a copy, circle 169 on Post Card

Liquid Meters—Stainless steeel liquid meters capable of handling corrosive and non-corrosive liquids are featured in Form 94/10-1. List of corrosive liquids that can be handled included. Neptune Meter Co.
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Liquid Level Gage—Bulletin CP3709 describes Varec Fig. 8400 Series Dynamatic, a liquid level gage for working pressures to 300 psi. Tells how electric power drive utilized eliminates errors due to friction, and use of a displacer does away with float problems. Explains operation and features of this high-pressure tank gage, claimed lower in cost than comparable units. The Vapor Recovery Systems Co.
▲ For a copy, circle 171 on Post Card

Temperature Controls—Differential expansion type temperature controls are illustrated and described in Catalog G-25. Included are specifications for both electric and pneumatic instruments. Burling Instrument Co.
▲ For a copy, circle 172 on Post Card

High-Pressure Rotameter—Bulletin 131 covers an indicating rotameter designed for pressure to 5000 psig at 200 F. Incorporates detailed drawings, dimensions and capacity tables along with information on operation. Brooks Instrument Co., Inc.
▲ For a copy, circle 173 on Post Card

Instruments, Accessories—Illustrated and described in this 6-pp product bulletin are tachometers, adapters, flexible shafts, clutches and gear boxes. Features are detailed. Barbour Stockwell Instruments, Div. Curtis & Marble Machine Co.
▲ For a copy, circle 174 on Post Card

Vibration, Strain Meters—Bulletin K-19A describes instruments for measuring, recording and analyzing vibration and strain. Includes photos, data charts and specifications on vibration transducers and exciters, strain gages, load cells and beams and engine monitoring equipment. The Korfund Co., Inc.
▲ For a copy, circle 175 on Post Card

Numerical Control Systems—Sixteen-pp Catalog 308 contains detailed information on numerical control systems for use on a variety of metalworking machinery, including contouring controls and positioning systems. Provides specifications and application data. The Bendix Corp.
▲ For a copy, circle 176 on Post Card

Water Treatment Control — Hydrotrol, automatic water treatment control for cooling water systems, is the subject of this bulletin. Explains how Hydrotrol works, how it solves water treatment difficulties. Heller Laboratories, Inc.
▲ For a copy, circle 177 on Post Card

FINISHING EQUIPMENT—

Metal Finishing Systems — Applications for company's metal finishing systems and components are described in this product bulletin. Illustrates cleaning, pickling, electroplating, anodizing, packaged systems. Turnkey Engineering Co., Inc.
▲ For a copy, circle 179 on Post Card

Blast Cleaning Barrels — Sixteen-pp Bulletin 706 describes features and advantages of company's blast cleaning barrels with abrasive impeller. Dimensions and specifications table included. Pangborn Corp.
▲ For a copy, circle 180 on Post Card

Paint Spray Booths—Treatment of water in paint spray booths is covered in Folder F9443. Discusses problems which arise from use of untreated water in water wash paint spray booths, and describes properties of compounds which have proved effective with organic and synthetic coatings. Oakite Products, Inc.
▲ For a copy, circle 181 on Post Card

TOOLS, WELDING AND MACHINE SHOP—

Pipe Tools, Machines—This catalog, about 32-pp, presents company's complete line of pipe and tubing tools and machines. Sections of the catalog are devoted to tubing tools and machines; pipe wrenches, cutters, threaders, bolt dies and vises; power drives and power pipe machines. Fully illustrated, book provides construction and application data; includes price lists. The Toledo Pipe Threading Machine Co.
▲ For a copy, circle 182 on Post Card

Electronic Welding Equipment—Described in company's short form catalog is a line of electronic welding equipment, including power supplies, weld heads and handpieces. Includes specifications. Hughes Aircraft Co.
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Vibration Mounts—Described in this 8-pp bulletin is a line of vibration mounts employing "rubber-in-shear" principle to isolate vibration and suppress noise. Includes load-deflection curve. Hamilton Kent Mfg. Co.
▲ For a copy, circle 184 on Post Card

Oil Mist Control—Characteristics of electronic air cleaners and how they can be applied to collect oil mists resulting from operation of industrial machine tools are detailed in 8-pp Catalog 1450. Contains illustrations, diagrams and tables. Westinghouse Electric Corp.
▲ For a copy, circle 185 on Post Card

Disposable Wipers—Applications of disposable wipers for general purpose wiping, cleaning and polishing in industry are illustrated and described in this 12-pp product bulletin. Economy of disposable wipers is stressed. Kimberly-Clark Corp.
▲ For a copy, circle 186 on Post Card

OTHER EQUIPMENT—

Improved Cylinders — Advanced design and construction features of air and hydraulic cylinders are described in three new bulletins. Provided are enlarged cross-section views with detailed specifications, mounting styles and accessories. Bulletin 202 presents air cylinders, pressures to 200 psi; Bulletin 203 covers medium pressure (500 to 2000 psi) hydraulic cylinders; and Bulletin 204, high pressure (2000 to 3000 psi) hydraulic cylinders. Mo-Bar Hydraulics Co.
▲ For a copy, circle 187 on Post Card

Heat Exchangers—Twelve-pp Bulletin 302.1K1 describes two standard heat exchanger lines. Discusses applications and engineering features of the exchangers which have straight tubes, externally packed floating tube sheets, removable bundles, single- or two-pass design. Gives design and dimensional data for units in 6-to-31-in. and 6-to-17-in. sizes. American-Standard Industrial Div.
▲ For a copy, circle 188 on Post Card

Rectangular Collectors—Straightline sludge collectors are described in 28-pp Book 2746. New data provided enables selection of proper size tank for both Types H and L collectors. New mechanical details and arrangement drawings are illustrated. "Ten States Standards for Sewage Works" specifications for sedimentation tanks are reprinted. Also presented are illustrations of Uniflow and preaeration settling tanks to which Straightline collectors are adaptable. Link-Belt Co.
▲ For a copy, circle 189 on Post Card

Improved Defrost Systems—Form 5026 describes Heat Cycle defrost systems incorporating a completely automatic, time initiated-temperature defrosting. Schematic diagrams and specifications included. Dunham-Bush, Inc.
▲ For a copy, circle 190 on Post Card

Dust Collection Systems—Described in this product bulletin is a complete line of dust collecting, recovery and classifying equipment. Air pollution, material handling and classification, recovery of material from waste gases, and employee comfort are areas covered. Buell Engineering Co., Inc.
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Problem: Exhaust hoods that don't exhaust

This plant needs make-up air! If the exhaust hoods in your plant aren't doing their full job, chances are they are being outpulled by other fans. Other exhaust fans set up a vacuum by removing air faster than you replace it. Your plant needs make-up air...a supply of new air to replace exhausted air.

Without sufficient make-up air, exhaust hoods can't do their job properly. Plant air becomes contaminated with fumes, dust, and odors. Workers' health suffers. Absenteeism rises; production lags. Other vacuum problems crop up: hot spots at inside areas, cold drafts along walls.

Solution: install a make-up air system -- fans to bring in outside air, and heaters to temper it. A make-up air system like this cancels out vacuum, gives balanced heat and ventilation.

For technical help on make-up air, see your Consulting Engineer. Or call in Sturtevant application engineers. They're experts in handling air...whether you want to move it, heat, cool or clean it. J-80711

WESTINGHOUSE ELECTRIC CORPORATION
Sturtevant Division, Dept. CE11
Hyde Park 36, Mass.

Send me your make-up air booklet.

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COMPANY_____

ADDRESS_____

PHONE_____

You can be sure...if it's **Westinghouse**

For more facts circle 640 on Reply Card

BULLETINS

(Begins on page 21)

TCL Analysis—Total cost of lighting analysis designed to get a bigger return on lighting investment is the subject of this product bulletin. Tells how to figure total cost of lighting and how to estimate savings possible. Sylvania Lighting Products.
▲ For a copy, circle 192 on Post Card

Maintenance Management—Establishing an effective maintenance program is the subject of this 12-pp illustrated bulletin. Covers equipment records, preventive maintenance scheduling, maintenance project scheduling and controlling, classifying the maintenance inventory and inventory control. Remington Rand, Div. Sperry Rand Corp.
▲ For a copy, circle 193 on Post Card

Faster Repair Parts—Helpful Bulletin 24 offers solutions to the problem of getting machinery repaired and back into production fast and at minimum cost. Offers ideas on how to save time in machining parts, eliminate last-minute parts rejections etc. Also gives suggestions for avoiding many secondary operations. Includes physical properties, chemistry and tolerances for company's Stressproof steel bars. LaSalle Steel Co.
▲ For a copy, circle 194 on Post Card

For Technical Training—This 24-pp booklet presents information on company's electronics training packages. Describes and illustrates classroom demonstrator, basic circuit building blocks and laboratory chassis. Photos show how instructor builds complete and functioning circuits and how student confirms by experiment the principles demonstrated. Also describes training course material—instructors' manual and students' work book. Five "package" training courses are detailed covering electronics technology; industrial electronics; radio; communications; radar. Philco Tech-Rep Div., Philco.
▲ For a copy, circle 195 on Post Card

Power Positioner—Featured in 10-pp Catalog 500A is the Hanna-Power positioner designed for multiple positioning of electro-mechanical drives and for indicating positions of mechanical elements. Tells how it works and gives dimensions and specifications. Hanna Engineering Works.
▲ For a copy, circle 196 on Post Card

Metal O-Ring Selector—This simple-to-use slide rule is designed to assist in the specification of metal O rings. Covers ring diameters from ¼ to 50 in. and includes specifications for plain, plated and coated rings. The Advanced Products Co.
▲ For a copy, circle 197 on Post Card

Silicone Rubber Selector—Selector Chart CDS-145C is designed to aid in selecting the proper type of silicone rubber for a specific application. Contains comprehensive data on applications, typical properties, primary classes. General Electric Co.
▲ For a copy, circle 198 on Post Card

Long Fasteners—Described in 16-pp Bulletin B-115 are long fasteners and guns for all types of industrial fastening applications. Pneumatic nailers, staplers and pinners and various types of nails, staples and pins to be used with them shown. Spotnails, Inc.
▲ For a copy, circle 199 on Post Card

DATA FILE OF LITERATURE FOR THE PLANT ENGINEER'S LIBRARY

STANDARD CATALOGS, bulletins and handbooks are described here to help plant engineers maintain a permanent data file. To order this free literature, use the Reader Service Cards provided on pages 223 and 224.

PUMPS, COMPRESSORS

Multi-stage Pumps—Illustrated and described in 12-pp Bulletin 980 is a line of single suction multi-stage pumps hydraulically balanced for high efficiency. Sectional drawings, specifications, dimensions and general data are included. Buffalo Pumps Div., Buffalo Forge Co.
▲ For a copy, circle 301 on Post Card

Motor Mounted Pumps—Compact, fhp motor mounted pumps in capacities of ½, 1½ and 3 gpm are illustrated and described in Data Sheet SP-509. Includes specifications and performance data as well as dimensional drawings. Viking Pump Co.
▲ For a copy, circle 302 on Post Card

Nuclear Pumps—This bulletin describes centrifugal pumps for all types of nuclear pumping applications. Three basic types are covered—liquid metal, liner-motor and mechanically-sealed pumps, with general description and capacity ratings. Byron Jackson Pumps, Inc.
▲ For a copy, circle 303 on Post Card

Simplified Pump Selection—Technical data is simplified in this company's rotary pump selection manual. Groups liquids according to viscosity and each classification has its own selection table. Fast selection is possible by matching liquid to pump. The Deming Co.
▲ For a copy, circle 304 on Post Card

Pump Selection Catalog—Included in 12-pp, easy-to-use Circular 184 are charts showing recommended temperature and pressure ranges for 10 classifications of company's pumps—from—350 F to +1000 F, and up to 1000 psig. Illustrations, descriptions and specifications are shown. Dean Brothers Pumps, Inc.
▲ For a copy, circle 305 on Post Card

Air Compressors—Design and construction details on company's semi-radial air compressors are presented in 24-pp Bulletin A-72. Illustrates semi-radial construction which results in better balance, less weight, and quick installation, and includes specification data. Joy Mfg. Co.
▲ For a copy, circle 306 on Post Card

Rotary Compressors—Described in 18-pp Bulletin C-5A are rotary compressors designed to operate at common electric motor and internal combustion engine speeds. Contains detailed specifications on compressors as well as on rotary vacuum pumps and illustrates typical installations. Fuller Co.
▲ For a copy, circle 307 on Post Card

To Speed Construction—Portable compressors, tractor compressors designed especially to speed work and reduce costs of construction are described and pictured in 8-pp Bulletin CG-15. Also presented are pneumatic air tools for use with the portable compressors. Le Roi Div., Westinghouse Air Brake Co.
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Water-Cooled Compressors—Featured in 12-pp Bulletin WB10 are two-stage water-cooled air compressors designed to meet the demand for small machines having efficiencies comparable to those of large two-stage horizontal compressors. Cutaway views showing component features included. Gardner-Denver Co.
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Compressed Air Fundamentals—Sixteen-pp Form 1548A is intended to aid in selecting a small, "packaged" air compressor. Discusses compressed air, how it is compressed, single- and two-stage compressors, piston displacement, control used, etc. Includes information on compressor oils, pipe sizes, wire sizes. Ingersoll-Rand Co.
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PACKINGS, SALES

Compression Packings—Featured in this 22-pp catalog is a line of compression packings, including both sheet and rod seal types. Describes packing materials and includes sections on recommended packings for various services, including air and inert gases, pharmaceuticals, foodstuffs and beverages, paper and textile processing, water, petroleum, and acid service, alkalis and steam service, others. E. F. Houghton & Co.
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Mechanical Seal—Performance and design features of Mechanipak PK mechanical seals for a variety of operating conditions are detailed in 8-pp Bulletin AD-150. Cutaway views, diagrams and tables of dimensional data included. Garlock, Inc.
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Teflon Products—Three bulletins present this company's Teflon packings, gaskets, special parts and stock. Bulletin CP552 describes Chempro lines of Teflon ring packings, Teflon impregnated asbestos packing, V-type packing and Teflon seal cage—for use

The nearsighted MISTER MAGOO says . . . "1956? A banner year! Princess Grace was married—unfortunately I couldn't attend—and General Electric invented the Power Groove Lamp. Happy birthday, Power Groo—Bowser! drop that salami! You've taken enough bites out of it already!"

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G-EXCLUSIVE! Power Groove® cuts your initial costs as much as 40¢ a sq. ft.

General Electric Power Groove Lamps start saving you money the day you specify them.

By any standard of comparison, they give you more light—with fewer lamps—than any other fluorescent type or brand. If you're building or remodeling, Power Groove Lamps *can save you up to 40¢ per square foot of lighted floor area* right off the bat.

Just the beginning. With fewer lamps, fixtures and ballasts overhead, your maintenance men spend less time on ladders.

Your employees' increased efficiency helps pay for Power Groove Lamps. If every reject makes you wince, consider how improved lighting—at no extra cost—might spruce up your operation. Perhaps you can remove the individual lamps that light only machines or tables.

General Electric's 5-year-old secret is in the grooves. They bend a 9-ft. arc stream through an 8-ft. tube and swing it closer to the light-producing phosphor coating. No other fluorescent lamp compares with the Power Groove. Call your General Electric Lamp distributor when *you* need lamps. General Electric Co., Large Lamp Dept. C-14, Nela Park, Cleveland 12, O.

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For more facts circle 641 on Reply Card

DATA FILE

(Begins on page 228)

with acids and strong chemicals. Bulletin CP553 covers Teflon jacket gaskets, solid ring gaskets, expansion joints and special gaskets. Bulletin CP554 illustrates special parts. Chemical & Power Products, Inc.
▲ For a copy, circle 313 on Post Card

O-Ring Handbook—Catalog 5711 is a 24-pp design and data book on Viton O-rings. Contains test information on some 150 fluids and gases to which this synthetic elastomer is compatible; recommended design techniques; general information on three compounds and dimensions; and data on all standard sizes. Among technical material provided are do's and don'ts regarding Viton O-rings, compression set graph. Parker Seal Div., Parker-Hannifin Corp.
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ELECTRICAL

A-C Motors—Brief presentation of company's major lines of motors, is given in 8-pp, colorfully illustrated Bulletin F-1878. Covers motors from fractional to 1000 hp, horizontal and vertical, dripproof/totally-enclosed/explosion proof. Shows gearmotors, variable speed and automation systems. Explains special design and construction figures such as Lubriflush transverse bearing lubrication. U.S. Electrical Motors Inc.
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Shielded A-C Motors—Comprehensive 56-pp Catalog 200 includes complete dimensional, selection and application data on company's Multi-Shielded a-c motors. Includes information for various modifications, such as specialized mountings and enclosures, as well as multi-shielded dripproof motors. Sterling Electric Motors, Inc.
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Secondary Unit Substations—Detailed information on secondary unit substations—complete and compact load distribution centers for indoor or outdoor application—is supplied in 24-pp Bulletin 3104-1A. Contains data and specifications on a large variety of primary devices, transformers. I-T-E Circuit Breaker Co.
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Distribution Transformers—Dry type distribution transformers, single and three phase, are featured in 16-pp Bulletin 5A2-BL01. Wiring diagrams and detailed specifications are included. Acme Electric Corp.
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High Voltage Control—This 16-pp booklet discusses general features of company's high voltage control equipment. Details individual characteristics of both full and reduced voltage types of high voltage control for squirrel cage, synchronous and wound rotor motors. Ratings, dimensions listed. Cutler-Hammer Inc.
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Panelboards—Advantages of company's panelboards which are assembled with screw-on circuit breakers are detailed in Bulletin 305-2. Table of ratings and sizes is included, as well as typical wiring diagrams. Frank Adam Electric Co.
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Enclosed Switches—Catalog 83, 22-pp, Catalog 84, 16-pp, and Catalog 101, 24-pp, describe enclosed switches for industrial uses. Included are general switches designed for use on either a-c or d-c applications, sealed switches, heavy-duty limit switches, hand operated switches, and other types. Micro Switch Div., Minneapolis-Honeywell Regulator Co.
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Capacitor Guide—Featured in 20-pp Catalog C-913 are electrolytic capacitors for capacitor-start motors as well as capacitors for permanent split-phase capacitor motors, and capacitor-start, capacitor-run units for use in air conditioning. Selection tables and interchangeability guide included. Sprague Products Co.
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Reduced Voltage Starting—Automatic reduced voltage starting for low voltage squirrel cage motors is covered in 16-pp Publication 6088. Describes general theory of reduced voltage starting and includes selector chart for choosing correct starter for particular installation. Allen-Bradley Co.
▲ For a copy, circle 324 on Post Card

Flexible Electric Conduit—Performance and application data on company's line of flexible plastic covered electrical conduit, Liquatite, are featured in brochure. Electri-Flex Co.
▲ For a copy, circle 325 on Post Card

Sheathed Cable—Construction details and performance data on company's sheathed cable, available in steel, copper, aluminum and bronze, are presented in 16-pp bulletin 1031. Complete engineering data, installation information included. Simplex Wire and Cable Co.
▲ For a copy, circle 326 on Post Card

Cable Support—Described in 28-pp Catalog 5912 are two types of cable trays or tube raceways, the ladder type and the basket small opening type, for cable, wiring and tubing support. Detailed dimensional data, transverse loading data, specifications, photos and diagrams are included. The Globe Co.
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Polyethylene as Insulation—Bulletin RCT 710 is a 10-pp technical paper on flame retardant polyethylene as insulation for wire and cable. Generously illustrated with tables and charts, this paper includes a bibliography and an appendix giving specifications for black flame-retardant polyethylene jacket insulation. Rome Cable Div., Aluminum Co. of America.
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Cords, Extensions—Illustrated and described in 24-pp Catalog 3-59 is company's line of cord sets and extensions for a variety of applications. Listed are power supply replacement cords. Royal Electric Corp.
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Neoprene Connectors—Featured in Bulletin H-796 are Neoprene connectors and caps offering acid, oil, water and impact resistance. Twenty ampere sizes are listed, along with advantages and typical applications. Harvey Hubbell, Inc.
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Renewable Fuses—The first section of 12-pp Bulletin 1320, discusses construction and application features of two types of renewable fuses—ferrule and knife-blade—as well as renewal links to facilitate replacement. Salient features are highlighted by sectional and cutaway drawings. Ordering information and specifications of the 250-v and 600-v fuses are covered in the second section. Federal Pacific Electric Co.
▲ For a copy, circle 331 on Post Card

Electrical Equipment Digest—Electrical equipment illustrated and described in 168-pp Catalog Digest No. 143, includes load centers, circuit breakers, low voltage control, fusible service equipment and accessories, meter sockets and troughs, safety switches, panelboards, duct and fittings, starters. Square D Co.
▲ For a copy, circle 332 on Post Card

Basic Electrical Protection—Ten-pp Form BPB explains interrupting capacity, speed of response and current limitation it contains detailed information on motor protection, system selectivity to faults, fuse applications and selection. Tells how to coordinate opening time of protective device so that fault current will be isolated to circuit of origin, and includes charts on opening and current limitation. Bussmann Mfg. Co.
▲ For a copy, circle 333 on Post Card

Electrical Products—Condensed Catalog No. 9 contains 48-pp of descriptive data on company's line of electrical products, including conduit bodies, conduit fittings, connectors, ground fittings and EMT fittings. Dimensional data and features are shown. Gedney Electric Co.
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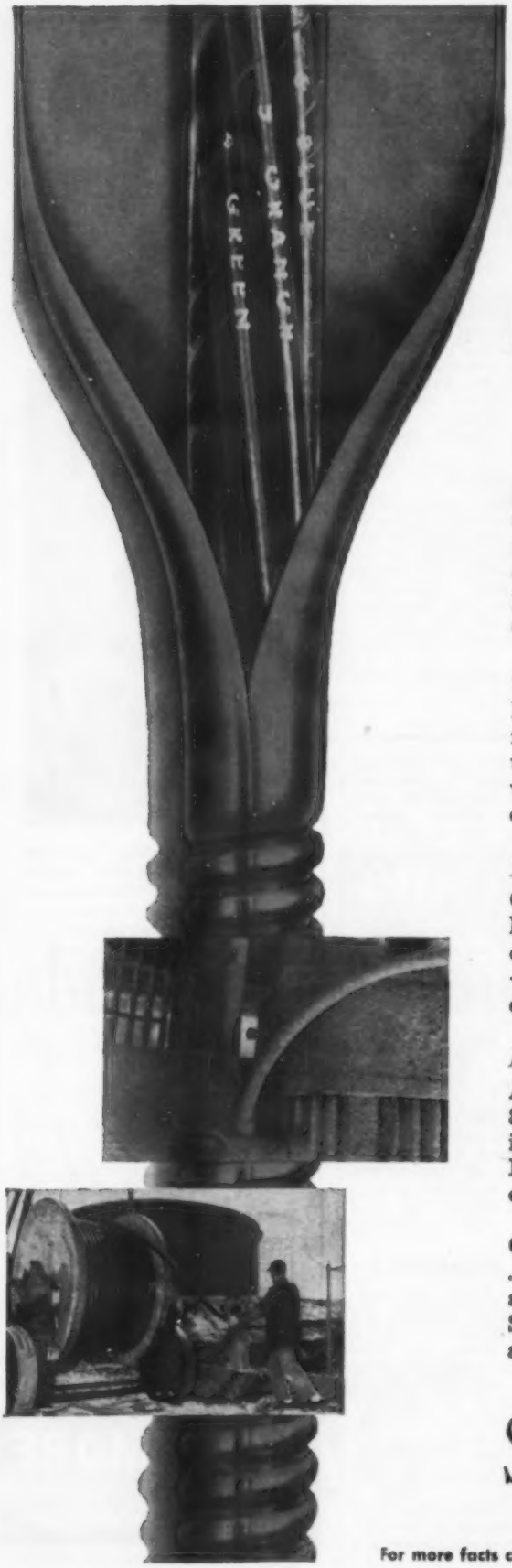
Wiring Devices—Catalog 60, about 80-pp, presents ordering data on wiring devices including a wide range of switches, convenience outlets, lampholders, fluorescent devices, cord connectors, adapters, wall plates, accessories, etc. Fully illustrated with photos, catalog provides condensed information on features, dimensions, applications. Pass & Seymour, Inc.
▲ For a copy, circle 335 on Post Card

For Corrosive Spots—Sixteen-pp Bulletin 2699 on Condulets for corrosive locations, discusses corrosion-resistant properties of a variety of metals and finishes utilized. Charts show application of each. Also provides formal listings of Plast-A-Coat Condulets for hazardous and non-hazardous spots. Crouse-Hinds Co.
▲ For a copy, circle 336 on Post Card

Testing Instruments—Twelve-pp Bulletin 19-60 contains descriptive information on company's line of instruments for industry, including electrical resistance testers, dielectric test sets, cable fault locating equipment, turn ratio test sets, others. Advantages given. James G. Biddle Co.
▲ For a copy, circle 337 on Post Card



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Sealed Cable Systems by Simplex Can do so Many Jobs so Well

Simplex C-L-X is a packaged combination of cable and an extremely pliable, corrugated metal sheath. It requires no separate duct or conduit regardless of environment. It is available with steel sheath and plastic jacketing; and with copper or aluminum sheaths, with or without plastic jacketing.

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By using a single length of 3-conductor 15KV C-L-X for both underground and aerial use, a Southeastern utility company saved more than 20,000 dollars from what it would have cost for a complete underground duct system.

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Conduit life in this company's calcium chloride reclamation building was only 6 to 9 months. The conduit was replaced with a C-L-X cable system which — after two years of operation, shows no signs of deterioration.

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An East Coast petroleum tank farm used a C-L-X 8-conductor cable protected with PVC for direct burial in ground that was saturated with oil, gas and water. Result: Perfect performance at a sizeable savings over conduit systems.

Only Simplex C-L-X offers you: Exceptional Strength . . . Unequalled Pliability . . . Protection from Liquids and Gases . . . Faster Installation and Lower Costs. Send for Illustrated Brochure containing Application and Engineering Data.

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NEW COCHRANE UNI-PAC* PACKAGED DEMINERALIZER

controls your least uniform raw material ...WATER

Units now available with both manual & automatic controls.

Are seasonal changes in the mineral content of your water supply a costly headache? Maintain quality standards year round with this *new* Cochrane Uni-Pac Packaged demineralizer, designed expressly for process systems. Sizes to 3500 GPH factory assembled, easily installed and operated. Send for Publication 5819.

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DATA FILE

(Begins on page 228)

Control Batteries—Twelve-pp Bulletin CP-539 describes batteries for control, switchgear and auxiliary power. Construction details are illustrated and described, and specifications are given as well as discharge curves. C & D Batteries, Inc.
▲ For a copy, circle 338 on Post Card

Charge Control—Installation and use of company's charge control unit, which simplifies daily and equalizing charging of batteries for electric industrial trucks and others, are described in Bulletin Form 5092. Featured are instructions and diagrams showing charging methods. Exide Industrial Div., The Electric Storage Battery Co.
▲ For a copy, circle 339 on Post Card

Battery Technology—Bulletin GB-1896 is a 36-pp handbook of technical instructions and engineering data on the care of motive power storage batteries. Covers all phases of lead acid battery theory, operation and maintenance. Provides basic information on specific gravity changes, charging cycles. Gould-National Batteries, Inc.
▲ For a copy, circle 340 on Post Card

LUBRICATION

Organized Lubrication—Benefits of organized lubrication—major cost control factors are extolled in this 24-pp bulletin. Cost control opportunities are detailed and the task of assigning responsibilities and delegating authority are covered as well. Texaco, Inc.
▲ For a copy, circle 341 on Post Card

Lever Guns—Bulletin 732 describes lever guns designed to handle lube cartridges and to dispense bulk grease. Describes convenient three-way reloading and other features. Lincoln Engineering Co.
▲ For a copy, circle 342 on Post Card

Lithium-Base Grease—Described in this 8-pp Booklet SP-9489 is a heavy-duty, multi-purpose lithium-base grease designed for use where loads are high, shock loads may occur, and where machine element action is oscillating. Advantages and typical applications are listed. Gulf Oil Corp.
▲ For a copy, circle 343 on Post Card

INSTRUMENTS, CONTROLS

Industrial Controls—This 92-pp catalog describes automatic controls for commercial, industrial plant, or process requirements giving specifications, diagrams, application data. Presents Hydramotor electro-hydraulic valves and actuators; Tork-Master electric valve operators; Hammel-Dahl air-operated proportioning valves and Foster steam specialty and regulator valves and flow tubes. General Controls Co.
▲ For a copy, circle 344 on Post Card

Data System—Functions of the Kybernetes Series 2000 data system are

FOR MORE USES... MORE SAFETY— BUY Bally-Hi

Open construction design allows the "Bally-Hi"—a two-stage ladder mounted on a wheeled frame—to move between and over obstacles such as machines—where ordinary ladders can't go. Collapsible outriggers prevent tipping. Reaches heights to 25 ft., anchors to floor firmly, goes through average size doorways when collapsed. Equipped with extra safety and comfort features that contribute to the user's sense of security. "Bally-Hi" may be truck-mounted.

Ballymore "Safety-Step" ladders serve industry.

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Special maintenance on your Deming pumps probably won't cost you a nickel! Years of trouble-free performance is the rule; emergencies rarely occur.

Dependable Demings save you money in other ways, too. When routine servicing is performed, spare parts inventory is light because Deming parts are standardized and readily interchangeable. Plant expansion costs less because Deming pumps are designed for adaptation to your growth requirements.

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ADDRESS_____
CITY_____ ZONE____ STATE_____

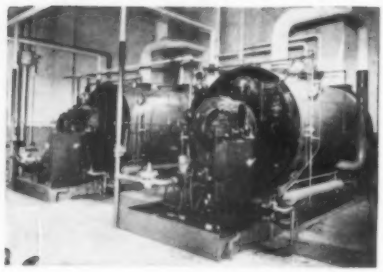
For more facts circle 645 on Reply Card

MINIMUM MAINTENANCE

WITH

Johnston

PACKAGED BOILERS



Here's Why—

- Johnston pioneered the waterback boiler design that eliminates refractory baffles and tube sheet failure due to overheating. No more expensive down time to replace combustion chamber refractories.
- All Johnston Packaged Boilers have full 5 square feet of heating surface per boiler H.P., ASME measured, for long-lived dependability.
- For fast, easy installation and undivided responsibility, Johnston Packaged Boilers are completely factory assembled and fire tested before shipment.
- Forced draft design requires only a simple exhaust vent. No costly stacks or foundations.
- To assure lasting satisfaction, factory trained technicians inspect and start each new installation and train your operators.
- Sizes from 20 to 750 H.P., 15 to 250 lbs. working pressure, with quiet dependable burners for heavy oil, cold oil, gas or fast easy changeover combination.

For further information write

JOHNSTON BROTHERS, INC.

FERRYSBURG, MICHIGAN

Pioneers of waterback boiler design

For more facts circle 646 on Reply Card

DATA FILE

(Begins on page 228)

presented in this 12-pp bulletin. Covers inputs, d-c amplification, analog-to-digital conversion, linearization, programming, integration, computer control and others. Specifications for all components and functions of the system, together with a typical system block diagram given. Hagan Chemicals & Controls, Inc.

▲ For a copy, circle 345 on Post Card

Automatic Controls—Selection and application information on a line of automatic controls for steam and water service is presented in this 46-pp Engineer's Manual. Covers controls for fuel oil heaters, heat exchangers for cooling, instantaneous heat exchangers, jacket water cooling, process hot water, pressure reducing. The Powers Regulator Co.

▲ For a copy, circle 346 on Post Card

Tank Contents Gaging—Bulletin 463A describes a line of remote and direct reading tank contents gaging systems, including hydrostatic, hydraulic and direct reading gages. Details on operation are illustrated. The Liquidometer Corp.

▲ For a copy, circle 347 on Post Card

Photo-Electric Control—Eight-pp Bulletin IB-2 describes an infra-red photo-electric control, Infrabeam, which functions by reflected or interrupted beam over long range. Typical materials handling, counting, inspection and control installations are illustrated with specifications and descriptions of models and accessories. Cramer Controls Corp.

▲ For a copy, circle 348 on Post Card

For Boiler Blow-Off—Basic facts about boiler blow-off and its control with an orifice meter flow control unit are presented in this 8-pp product bulletin. Engineering and operating principles of the flow control unit are detailed on cross-sectional view. The Madden Corp.

▲ For a copy, circle 349 on Post Card

LIGHTING, COMMUNICATION

Modern Lighting Needs—"Footcandles in Modern Lighting," is a 20-pp revised booklet giving lighting level recommendations for seeing tasks involved in hundreds of industrial and other activities. Figures are based on the findings of Illuminating Engineering Research Institute and Illuminating Engineering Society. General Electric Co.

▲ For a copy, circle 350 on Post Card

Industrial Lighting — Construction features and advantages of localized lighting units for a variety of industrial applications are detailed in 12-pp Catalog 66. Dimensional data and illustrations are included. Adjustable Fixture Co.

▲ For a copy, circle 351 on Post Card

Lighting Selector—A simplified lamp and lighting guide for plant and office lighting installations, this 24-pp bulletin contains tables giving rec-

NO MORE STICKING

in processing such as coating or laminating, when you use new, heat-resistant

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the roll covering that offers excellent release characteristics. Ask your S-W Sales Engineer for the technical bulletin on ROLEASE®, or write:

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For more facts circle 647 on Reply Card

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Capacities: 200 to 1200 amps.
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IMP* "talks" any industrial vehicle into more work . . . and does it quietly. This mobile, two-way radio system gives your orders with clear, crisp authority and gets things done . . . NOW! IMP* is rugged, priced right, easy to install, and economical to operate because it's built by KAAR. Use IMP* as base transmitter, mobile unit, or P. A. system, and then, if you must shout, you can shout about savings!

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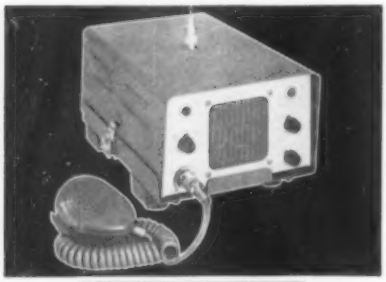

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For more facts circle 649 on Reply Card

DATA FILE

(Begins on page 228)

ommended illumination levels, and information on how to obtain them with fluorescent, mercury or filament lamps. Illustrated with products of ten manufacturers showing equipment recommended and listing user prices. Graybar Electric Co., Inc.
▲ For a copy, circle 352 on Post Card

Lamp Data—Incandescent and fluorescent lamps are featured in 16-pp ordering catalog and price schedule, Form 2B. Selection tables list complete descriptive and electrical details. Champion Lamp Works.
▲ For a copy, circle 353 on Post Card

Group Relamping Plan — Eight-pp Booklet A-6832 describes a group relamping plan designed to reduce costs, provide better lighting, and cause fewer work interruptions. Sample calculations provide data for setting up relamping schedule. Westinghouse Electric Corp.
▲ For a copy, circle 354 on Post Card

Commercial literature reviewed on these pages can keep you posted on what's available in plant engineering equipment. To order, use the Reader Service Cards on page 224.

Lighting Unit—Dust and moisture resistant lighting units for use wherever lamps, electrical components, and reflecting surfaces must be protected for sanitary or safety reasons are described in this product bulletin. Applications in food, processing plants, pharmaceutical plants, others, listed. The Miller Co.
▲ For a copy, circle 355 on Post Card

Lighting Fixtures—Illustrated and described in 24-pp 1961 Catalog are lighting fixtures for commercial and industrial applications. Includes selection tables for surface mounted, suspended mounted, special purpose, recessed, and industrial hangers and accessories. Day-Brite Lighting, Inc.
▲ For a copy, circle 356 on Post Card

Signal Equipment—Tips on how to select suitable signals for any specific operations are offered in Bulletin 100. Describes horns, bells, warning lights, other signal equipment. Specifications, photos, wiring diagrams, dimensions, audibility rating charts. Federal Sign & Signal Corp.
▲ For a copy, circle 357 on Post Card

Communication System—Featured in this bulletin is a transistorized communication system designed to provide communication between two or more persons or departments regardless of distance or surrounding noise conditions. Gai-Tronics Corp.
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DUST, FUME CONTROL

Dust Collectors—Self-contained cabinet cloth-filter type dust collectors

. . . and for

NEARBY SERVICE on Black & Decker tools.

Black & Decker maintains 50 factory service branches plus authorized service stations to give your B&D tools the attention mechanical products need periodically. Keep your B&D tools in top condition, on the job all the time.

Only factory parts and factory-approved methods are used. Fast service and reasonable cost, always.

SWIFTY SERVICE says be sure to ask about:

FREE TOOL INSPECTION no cost, no obligation.

STANDARD B&D GUARANTEE after completion of all recommended repair work.

You'll find the location of the nearest B&D repair facility in the Yellow Pages under "Tools-Electric," or write for address to: THE BLACK & DECKER MFG. CO., Dept. 0803-S, Towson 4, Md.

50th YEAR

See Tools-Electric -Yellow Pages- for Service & Sales

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Quality Tool Service

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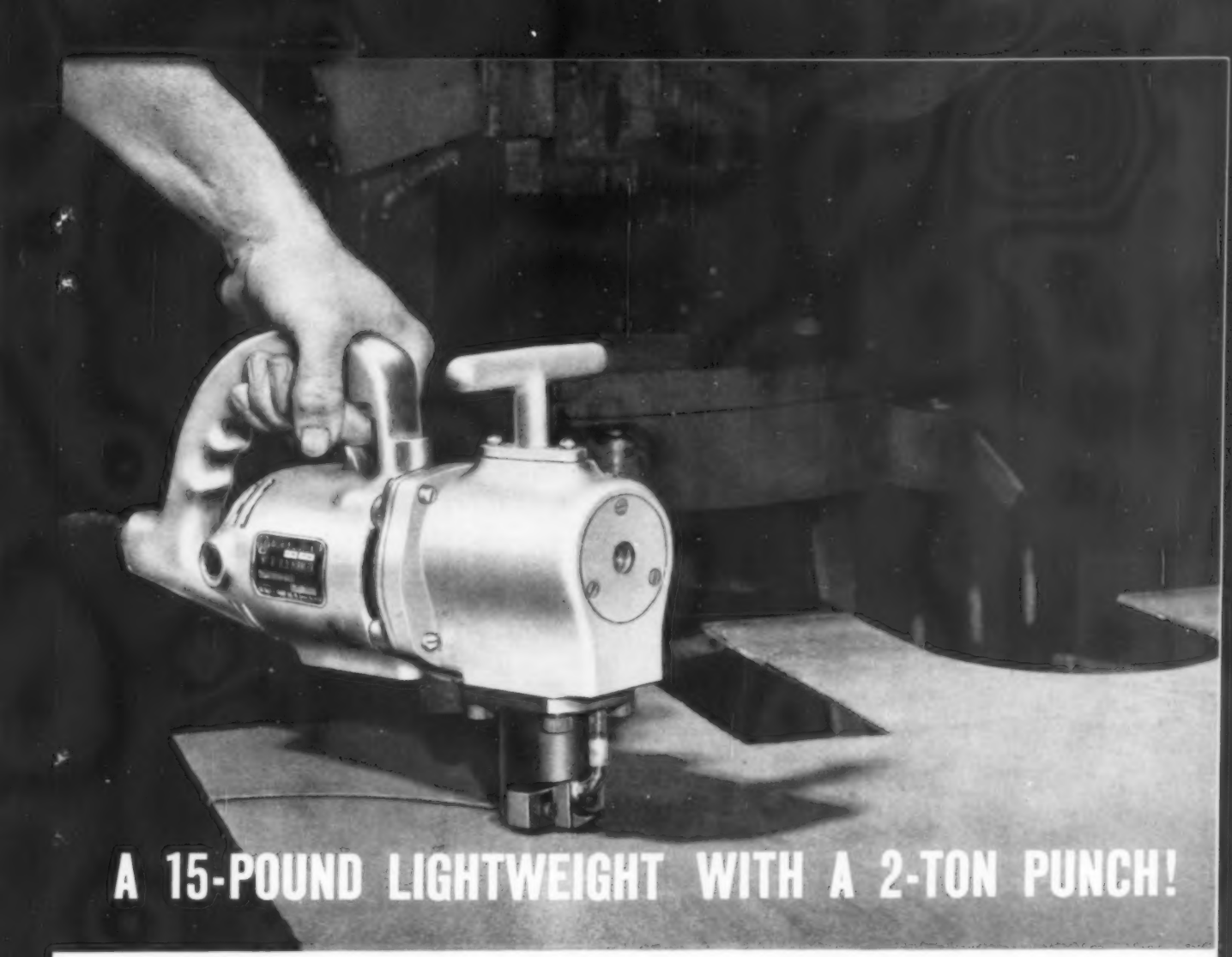

A 15-POUND LIGHTWEIGHT WITH A 2-TON PUNCH!

Introducing the new Black & Decker No. 8 H.D. Nibbler

Take big bites out of your heavy work, bring the tool to the job and slash cutting costs . . . with the all-new portable Black & Decker No. 8 Heavy-Duty Nibbler. Its 2-ton punching wallop cuts smoothly through 8-gauge plate, goes through heavy-gauge tubing and corrugated (most stainless, too) like a knife through butter . . . replaces torch cutting, eliminates edge grinding.

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There's a new and improved Black & Decker No. 16 Nibbler, too, for up to 16-gauge metals. See both new Nibblers now. They're sold by leading distributors everywhere. *For sales or service, look in the Yellow Pages of your telephone book under* [illegible] ELECTRIC

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CUTS MAN-HOURS TO MINUTES

NEW No. 16 NIBBLER speeds through corrugated, straight or circle cuts with the greatest of ease. Won't bend or curl metal. Reversible punch for double life.

No. 16 SHEAR cuts easily through metal sheet . . . follows pattern lines perfectly. B&D also has No. 12 Shear for heavier metal, No. 18 for lighter work.

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For more facts circle 651 on Reply Card

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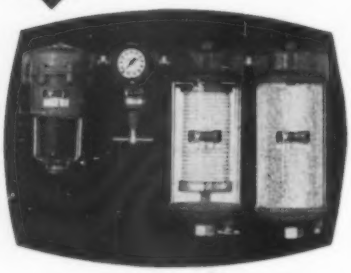
for "instrument-pure" compressed air.

The WILKERSON "Chem-Guard" package provides micro-clean, dehydrated, oil-free air *only where needed.*



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★ **LOWEST PRICE** for package, application and installation. No electrical, water or sewer connections needed.

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★ **BUILT-IN VISIBLE INDICATOR** shows color change when servicing is required.

Choose the non-corrosive chemical to suit your needs

(a) reduce dew point to—40° F or
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WRITE TODAY for complete information on the NEW "Chem-Guard".

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For more facts circle 652 on Reply Card

DATA FILE

(Begins on page 228)

are illustrated and described in this 6-pp Bulletin 359. Design details included. Torit Mfg. Co.
For a copy, circle 359 on Post Card

Dust Control Systems—Bulletin 104, 36-pp, on company's dust filters, gives detailed information about dust control systems and how to engineer them. Includes description of the Roll-Clean Dynaclone dust filter, as well as information on other dust filters. The W. W. Sly Mfg. Co.
For a copy, circle 360 on Post Card

Dust and Fume Control—Applications of company's dust and fume control systems in ceramic, foundry, grain, metal, steel and wood industries are illustrated and described in 50-pp Bulletin PE1-2. Design and specification data on centrifugal collectors. The Kirk & Blum Mfg. Co.
For a copy, circle 361 on Post Card

Dust Controller—Bulletin 5002-2 describes the Verticone conditioner designed for dust-free handling of bulk dry materials by continuous controlled wetting. Typical applications in dust collector bin discharge, fly ash conditioning, blast furnace flue dust discharge, dusty bulk materials handling described. Johnson-March Corp.
For a copy, circle 362 on Post Card

VALVES, TRAPS, FITTINGS—

Stainless Steel Valves—Corrosion resistant stainless steel valves are featured in 32-pp Catalog 59SS. Features of design and construction are shown through cutaway views, and advantages of stainless steel in withstanding corrosive chemicals and atmospheres detailed. Jenkins Bros.
For a copy, circle 363 on Post Card

Butterfly Valves—Resilient-seated type butterfly valves for applications where positive tight closure is required are illustrated and described in Bulletin 590X. Advantages and oustanding features are detailed. W. S. Rockwell Co.
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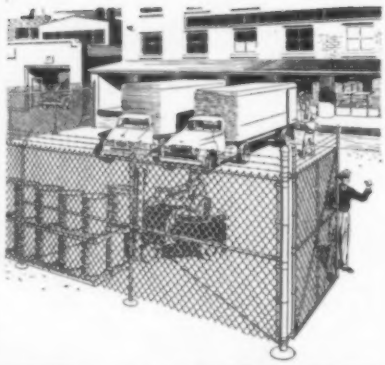
Iron Body Gate Valves—Service ratings, sizes, dimensions and material specifications are listed in this bulletin on iron body gate valves for construction, gas transmission, chemical, electric and petroleum fields. Cast iron wedge gate valves listed for steam, water, oil, gas. Walworth Co.
For a copy, circle 365 on Post Card

Steel Valves—Catalog 120 contains 42 pp of detailed information on cast and forged steel valves, including gate valves, check valves and globe valves. A table listing properties of ferritic and austenitic steels is included, as well as specifications and design data, dimension tables, dimensional diagrams, ring joint dimensions. The Chapman Valve Mfg. Co.
For a copy, circle 366 on Post Card

Impulse Steam Traps—Capacities, dimensions, weights and materials of construction of company's impulse steam traps are covered in this prod-



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ALUMINUM for LONG LIFE ... STEEL for STRENGTH

PAGE'S new ACCO-*Aluminized* chain link fabric is a superior product that means plus value for you. The strong steel wire has a bonded coat of commercially-pure aluminum. Result? Definitely, **QUALITY**. ACCO-*Aluminized* has the strength of steel plus aluminum's longer-lasting non-corrosive qualities.

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INSTALLATION is important. A fence can be no better than the quality of its erection. The PAGE FENCE Member in your locality is experienced, responsible and interested in your satisfaction.

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PAGE FENCE is engineered for long-lasting service and is covered by a Registered Certificate of Quality.

When you write us, we'll send the whole story in a helpful booklet and the name of our nearest Member. Call him, he will gladly suggest the best answer to your property protection problem.

Helpful booklet describes fence styles, gates and components

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A product of Page Steel & Wire Division American Chain & Cable Co., Inc.

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uct - bulletin. Potential installation savings due to combination steam trap, strainer and blow-down valve design detailed. Yarnall-Waring Co.
For a copy, circle 367 on Post Card

Steam Traps—This 1960 Condensed Catalog contains 12-pp of technical details, dimensions, and capacity data on steam traps, temperature regulators, and heating specialties. Cutaway views and diagrams are included. Sarco Co., Inc.
For a copy, circle 368 on Post Card

On Steam Traps—Catalog K is an enlarged 48-pp manual and steam trap catalog. New material provided includes open float and thermostatic traps, pipe strainer to 6 in. steel and semi-steel, and helpful steam pipe sizing tables. Discusses fundamentals of trapping, trap selection, installation. Armstrong Machine Works.
For a copy, circle 369 on Post Card

Steam Trap Primer—Fundamental facts about drainage and steam trap operation are presented in this 16-pp steam trap primer. Operating principles of steam traps are fully detailed, and data on steam trap maintenance and application included, as well as question-and-answer section covering common steam trap problems. Barnes & Jones Inc.
For a copy, circle 371 on Post Card

Trap Strainers—Eight-pp Bulletin 601 contains a chart listing case histories of typical trap strainer applications. Strainer size, materials of construction, metallic straining media, housings, screens flanges, and connections for specific applications in such industries are listed. Multi-Metal Wire Cloth Co., Inc.
For a copy, circle 372 on Post Card

Fluid Line Coupling—Catalog 100 contains data sheets describing company's line of quick-connective fluid-line couplings for pneumatic, hydraulic, oxygen, acetylene, steam, various gases and liquids service. The Hansen Mfg. Co.
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INSULATION

Pipe Insulation—Characteristics and advantages of snap-on one piece molded pipe insulation of glass fibers are detailed in this 10-pp bulletin. Material and application specifications for plumbing and heating, insulation of valves and fittings, cold piping and dual temperature, outdoor piping, etc. included. Gustin-Bacon Mfg. Co.
For a copy, circle 375 on Post Card

Fiber Glass Insulation—Applications and advantages of fiber glass as insulation are illustrated and described in this Product Bulletin F-100. Typical applications are shown and a table of dimensional data included. Pittsburgh Plate Glass Co.
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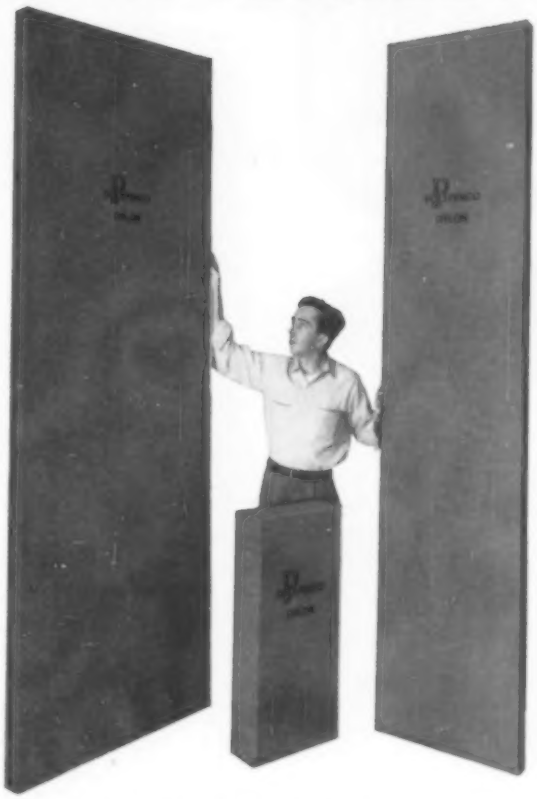
MECHANICAL POWER TRANSMISSION

Screw Conveyor Drives—Bulletin 7106 presents 20 pp of data on screw conveyor drives for applications in

NEW MASSIVE MC NYLON PLATE NOW AVAILABLE!



● Huge MC Nylon plate—the largest ever produced—is now available for wear plates, panels, tooling, fixtures and other applications which need nylon's unique mechanical or structural properties.

Polymer's exclusive revolutionary new processing techniques make production of large plate practical with price reductions of 15% under nylon plate presently available. Standard stock availabilities now include thicknesses from ½" up to 4" and in 2' by 4' sections. Availabilities to date were limited to 1½" maximum thickness in 10" widths. MC Nylon now opens new design possibilities and manufacturing economies. On special order plates of over 6" thickness in sections of 4 foot widths and 10 foot lengths can be supplied.

In tubular bars, the specially formulated bearing material now costs less than continuous cast bronze bushings of similar size, with prices up to 50% below other nylons.

MC Nylon tubular bars are made in OD's from 2" to 15" with wall thicknesses of ⅜", ½", ¾" and 1". Rod up to 17" diameter is also available with special larger sizes and shapes made to order. Supplied in Polypenco blue.

Call or write for full information.

POLYPENCO® *industrial plastics*

The Polymer Corporation of Pennsylvania
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For more facts circle 654 on Reply Card

CONSIDER THESE
FACTS
about REAL
RE-SCREENING
ECONOMY

1—Rescreening your used rings costs less than buying new rings.

2—Buying SOLID RINGS which can be re-screened MOST often saves MOST dollars in the long run.

MULTI-METAL OFFERS REAL ECONOMY by

1—Re-covering New "Non-Returnable" Rings—or

2—Recovering Old Solid Rings—or

3—Furnishing New Solid Rings good for many re-screenings

Whichever you choose, let Multi-Metal help you cut replacement costs.

MM MULTI-METAL WIRE CLOTH CO., INC.
1363 Garrison Ave., New York 59, N. Y.

For more facts circle 655 on Reply Card

DATA FILE

(Begins on page 228)

range from ⅛ to 30 hp, in four ratios, designed to bolt to standard trough ends. Design features and accessories are described, selection and dimensions given. The Falk Corp.
▲ For a copy, circle 377 on Post Card

Fluid Drive—Eight-pp Bulletin 9819 describes and illustrates adjustable speed Gyrol fluid drives, 1- through 25-hp, giving advantages and applications. Components and operation covered. Industrial Div., American-Standard.
▲ For a copy, circle 378 on Post Card

Grommet V-Belts—Advantages of company's grommet V-belts are illustrated and described in this 8-pp bulletin. Belt features are fully described and tips on how to figure a drive given. Goodall Rubber Co.
▲ For a copy, circle 379 on Post Card

Belting, Other Rubber Products—Illustrated and described in 40-pp Bulletin BHM-10 is a line of industrial rubber products, including V-belts and sheaves, V-belting and flat belts, hose and couplings, rubber lined products, and molded rubber goods. Includes dimensional tables, hose selector guide, descriptive data. The Gates Rubber Co.
▲ For a copy, circle 380 on Post Card

Power Transmission Products—Catalog 759 contains 104-pp of engineering data, specifications and prices on roller chain, sprockets, couplings, and conveyor chain. Data includes material on selection of roller chain drives, speed ratios for sprocket combinations, chain length tables, illustrations of various standard attachments. Diamond Chain Co., Inc.
▲ For a copy, circle 381 on Post Card

Drive Tensioners—Features and advantages of company's universal drive tensioner are detailed in this data sheet. Mounting dimensions and typical installation are diagrammed. Brewer Machine & Gear Co.
▲ For a copy, circle 382 on Post Card

Anti-Friction Bearings—Catalog 424-D covering "the broadest line in the anti-friction field," is an 8-pp folder giving capsule presentation of company's entire product line. A brief description of each product is provided. SKF Industries, Inc.
▲ For a copy, circle 383 on Post Card

Mounted Bearings—Comprehensive engineering data on pillow blocks, flange bearings, hanger bearings, bearing units and take-ups is presented in 82-pp Bulletin 10A. Includes dimensional data and diagrams, radial load rating tables, cutaway views showing component details of bearings, and detailed specifications. Dodge Mfg. Corp.
▲ For a copy, circle 384 on Post Card

Iron Pulleys—Standard construction of iron pulleys is illustrated and described in 20-pp Catalog 1-C. Includes tables listing pulley weight, diameters and face widths along with prices. The J. B. Ehrsam & Sons Mfg. Co.
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Stonehouse Signs say

No Smoking

where danger exists

STONEHOUSE NO SMOKING SIGNS help fight fire before it starts by constantly reminding workers—particularly in places where the most danger exists—to be careful.

All Stonehouse Signs are designed and manufactured to accomplish this purpose in the most effective manner. They are of the highest quality workmanship and materials and comply fully with American Standard Specifications.

Hundreds of different stock-worded accident-prevention signs are available for prompt shipment. Usually the same day your order is received.

DANGER
NO SMOKING MATCHES OR OPEN LIGHTS

NO SMOKING ALLOWED

DANGER
EXPLOSIVE GAS
NO SMOKING

Signs Since 1863

Write today for our free, full-color, 64-page catalog, plus information about custom-printed signs to meet your specifications.

Stonehouse SIGNS

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9th and Larimer Streets, Denver 4, Colorado
2155

For more facts circle 656 on Reply Card

SAFETY, FIRE PROTECTION—

Fire-Resistant Fluids—This series of specification sheets describes company's line of fire-resistant fluids including synthetic, oil-in-water and water-in-oil emulsion and glycol types. Mobil Oil Co., Inc.
▲ For a copy, circle 386 on Post Card

Fire Alarm Systems—Publication 246 contains 36-pp of detailed information on fire alarm systems for critical applications in industrial, institutional and other public buildings. Contains typical job specifications. The Standard Electric Time Co.
▲ For a copy, circle 387 on Post Card

Handling Flammable Liquids—Problems involved in the use of flammables in individual processes, and methods and equipment required for safe control are described in this 76-pp safety handbook. Physical properties and characteristics of most commonly used flammables are detailed; recommendations for safe handling given. The Protectoseal Co.
▲ For a copy, circle 388 on Post Card

MAINTENANCE—

Paint Economy—Factors to consider in selecting paints are detailed in this sixth edition of "Engineered Color," a 20-pp specifications catalog. Covers proper use of paint and color, requirements of various surfaces, color and the safety program. Describes interior and exterior primers and finishes, varnishes and floor sealers, and includes color chips. Barreled Sunlight Paint Co.
▲ For a copy, circle 390 on Post Card

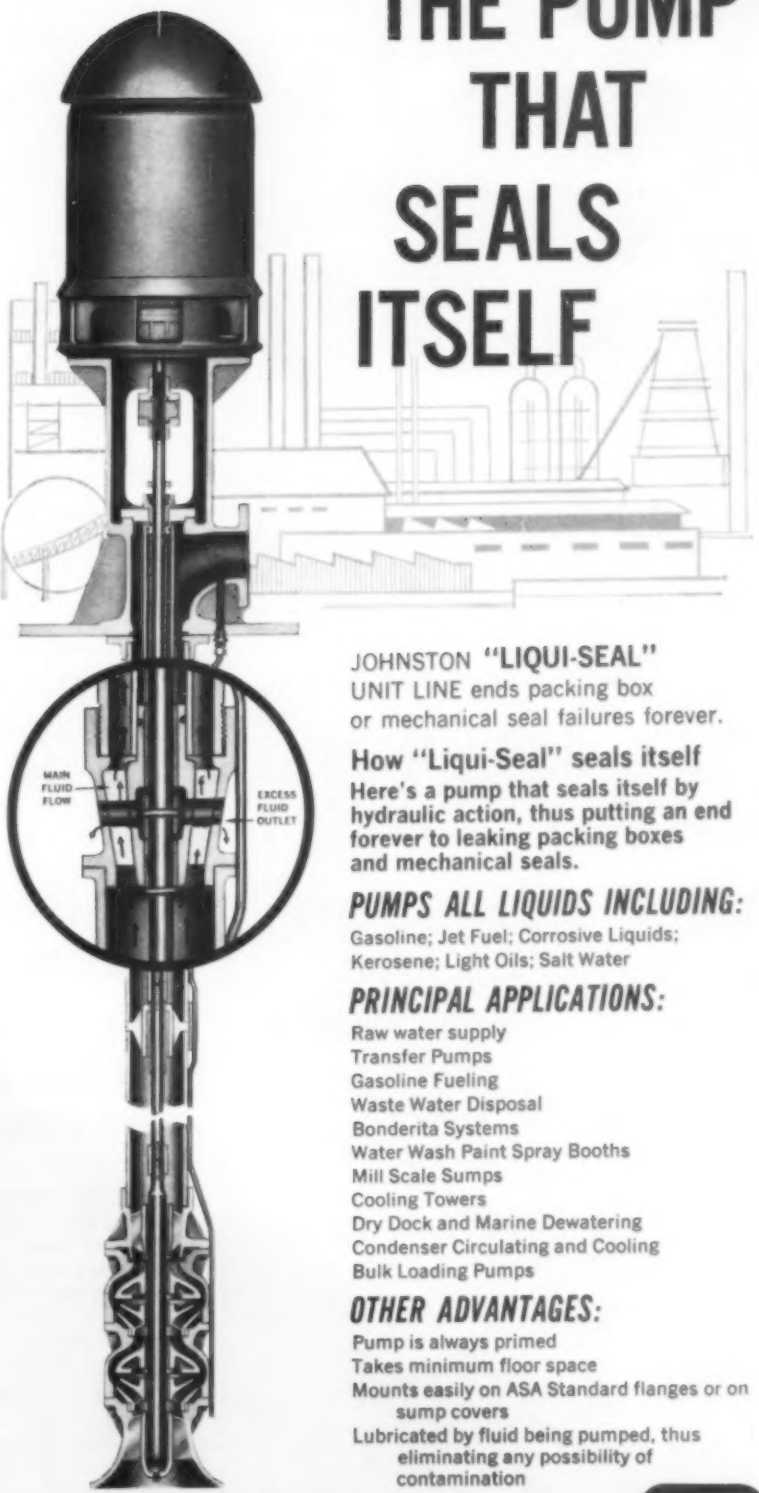
Protective Coatings—Latest developments in corrosion resistant coatings, treatments for floors, and coatings and waterproofing for masonry are described in 72-pp Form 990. Presents detailed information on maintenance products for interiors, door coatings, exteriors, new construction, roofs. Truscon Laboratories, Div. Devoe & Raynolds Co., Inc.
▲ For a copy, circle 391 on Post Card

Protective Coatings—This 38-pp comprehensive treatise (Form 259) on rust and corrosion control by protective coatings contains a gate-fold spread showing actual color standards of company's primers and top coatings. Covering water resistant, heat-resistant, floor coatings, heavy-duty chemical resistant coatings, galvanized metal coatings, wire fence roller coatings, and quick-dry coatings, booklet contains 110 color chips and full-color application pictures. Rust-Oleum Corp.
▲ For a copy, circle 392 on Post Card

Coating Systems—Described in this 16-pp bulletin are a number of protective maintenance coating systems designed to solve a variety of corrosive problems. Index tab indicates where a particular system should be applied, and copy explains features of each system. The Glidden Co.
▲ For a copy, circle 393 on Post Card

Sulfamic Acid Cleaners—Scale dissolution rates for sulfamic acid cleaners, plus a diagram sheet showing simple equipment cleaning hookups

THE PUMP THAT SEALS ITSELF



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UNIT LINE ends packing box or mechanical seal failures forever.

How "Liqui-Seal" seals itself
Here's a pump that seals itself by hydraulic action, thus putting an end forever to leaking packing boxes and mechanical seals.

PUMPS ALL LIQUIDS INCLUDING:
Gasoline; Jet Fuel; Corrosive Liquids; Kerosene; Light Oils; Salt Water

PRINCIPAL APPLICATIONS:
Raw water supply
Transfer Pumps
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Waste Water Disposal
Bonderita Systems
Water Wash Paint Spray Booths
Mill Scale Sumps
Cooling Towers
Dry Dock and Marine Dewatering
Condenser Circulating and Cooling
Bulk Loading Pumps

OTHER ADVANTAGES:
Pump is always primed
Takes minimum floor space
Mounts easily on ASA Standard flanges or on sump covers
Lubricated by fluid being pumped, thus eliminating any possibility of contamination

For complete details contact your nearest Johnston Distributor or write direct to the factory for colorful bulletin.

JOHNSTON PUMP COMPANY
3272 E. Foothill Blvd., Pasadena, Calif.
For more facts circle 657 on Reply Card

DATA FILE

(Begins on page 228)

are presented in this 8-pp product bulletin. Advantages of sulfamic acid cleaning and conclusions drawn from the data are listed. E. I. du Pont de Nemours & Co.
▲ For a copy, circle 394 on Post Card

Steam Cleaners—This 12-pp catalog illustrates and describes steam cleaners and hydraulic pressure combination cleaning systems. Detailed specifications on each model included. Malsbary Mfg. Co.
▲ For a copy, circle 395 on Post Card

Vacuum Cleaners—Bulletin 34, 8 pp, describes heavy-duty vacuum cleaners for industrial, commercial and other uses. Specifications, construction features, and illustrations are included. A furnace cleaner is also covered. The Black & Decker Mfg. Co.
▲ For a copy, circle 396 on Post Card

Electric Power Sweeper—A battery powered, aisle-designed, silent, fume-free sweeper is described in Bulletin 85. Photos, advantages, features and mechanical data also given. G. H. Tennant Co.
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Pyramid Ladders—Catalog 159, 20-pp, describes a line of pyramid-design step ladders, as well as hydraulic lifts and fixed or adjustable-level work platforms for above-floor working safety. Illustrates 35 new models of ladders for working heights up to 15 ft. Ballymore Co.
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Brushes For Industry—Included in 46-pp Catalog 200 on industrial brushes is a section on factors to consider in power brush selection. Illustrates and describes power and hand brushes for every type of industrial requirement and includes dimensional data and specifications. Newark Brush Co.
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TOOLS, WELDING AND MACHINE SHOP

Pipe Tools—Ordering and application information on Rigid pipe tools is provided in 16-pp illustrated Catalog 7596R-6. Wrenches, cutters, threaders, reamers, vises, and others are pictured and described, also power drives. The Ridge Tool Co.
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Industrial Tools—Information on a complete line of industrial tools, including 500 new types and sizes never before offered, is presented in 120-pp Catalog 57. Included are complete lines of wrenches, socket wrenches, drop forged clamps, tool holders, set up and hold down tools, cutting tools provided. Armstrong Bros. Tool Co.
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Industrial Wrenches, Hand Tools—Tools for production lines, maintenance work and product servicing are presented in 156-pp Industrial Catalog 58-I. Loaded with pictures and tool facts, book describes in detail the complete line of over 4,000 tools—including chests and roll-cabs, wrenches and sockets of all types, screwdrivers, pliers, pullers, etc. Snap-on Tools Corp.
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Maintenance Equipment—Industrial maintenance equipment for a variety of pulling-installing operations are illustrated and described in 24-pp Catalog P-9. Includes detailed specifications on pullers, push-pullers, puller adapters, pulling attachments, hydraulic rams and cylinders, pumps, industrial maintenance sets, hydraulic shop presses, and wrenches. Owatonna Tool Co.
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MATERIALS HANDLING

Electric Hoists—Six-pp illustrated Bulletin 905 describes R&M Type J electric wire rope hoists in capacities of ⅛, ½, 1 and 2 tons. Shows complete specifications including mounting options and sectionals. Hoist & Crane Div., Robbins & Myers, Inc.
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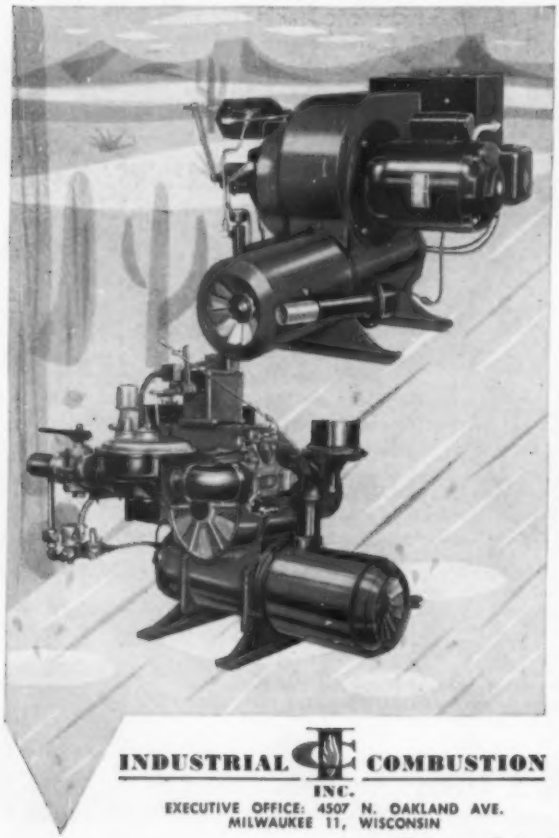
Small Heavy-Duty Hoist—Twelve-pp Bulletin 158-K describes the Lodestar, a heavy duty version of the small electric hoist, offering faster speeds, larger capacity (to 2 tons) and a greater range of both speeds and capacities. Details outstanding features of this plug-in hoist, illustrates available models and provides



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specifications, dimensions, prices. Chisholm-Moore Hoist Div., Columbus McKinnon Chain Corp.
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Load Handling Equipment—Illustrated and described in 20-pp Bulletin 15025 is load handling equipment including portable electric hoists, I-beam trolleys, differential chain hoist, trolley hoists, lever-operated hoists, electric hoists, driven trolleys, air hoists, jib assemblies and bridge cranes. Detailed specifications given. Manning, Maxwell & Moore, Inc.
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Vibrating Conveyors—Advantages and features of vibrating conveyors are detailed in 16-pp Catalog 66. Layouts and flow charts showing how conveyors can be designed to perform a wide variety of processing operations at the same time the material is being conveyed are included. Ajax Flexible Coupling Co., Inc.
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Conveyor Chains—This 38-pp engineering reference book contains comprehensive information on selection of chain for conveying and elevating. Correct application of chains to conveyor systems, development of attachments to increase their versatility and factors in selecting chains are outlined and a trouble shooting chart included. Moline Malleable Iron Co.
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Economical Bulk Handling—Bulletin 532, 6 pp, tells how plastic users save costs and get better productivity by modernizing methods for handling pelletized plastics. Shows examples of combination and suction-type pneumatic conveyor systems. Describes some installations ranging from an automatically controlled 11-system one to a smaller, yet versatile system used by a medium sized plant. Dracco Div., Fuller Co.
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All Steel Reels—Featured in 40-pp Catalog C-2 is a line of all steel reels, including air hose reels, belt reels, communication reels, hand-operated reels, instrumentation reels, lifting cables and cords, motor driven reels, spring-operated reels, and accessory equipment. Includes application suggestions, motor current tables, stretching, lifting and retrieving capacities. Gleason Reel Corp.
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Hydraulic Jacks, Pullers—Features and applications of company's hydraulic jacks and pullers for industrial and construction applications are detailed in 16-pp Hydraulic Catalog 60. Includes mechanical specifications and size charts. Templeton, Kenly & Co.
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Self-Dumping Hoppers—Cost-saving advantages of self-dumping steel hoppers for bulk material handling are detailed in Bulletin 265. Photos showing typical handling applications are included. Roura Iron Works, Inc.
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Car Shaker—Described in 6-pp Folder 2745 is a one-man operated railroad car shaker which incorporates a low-frequency vibration shaker mechanism for economical unloading

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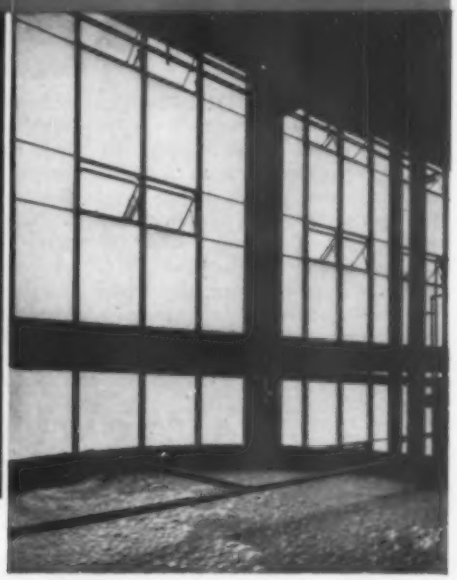

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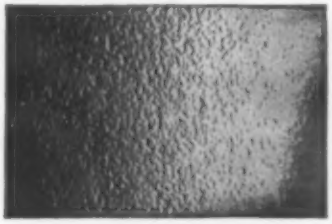

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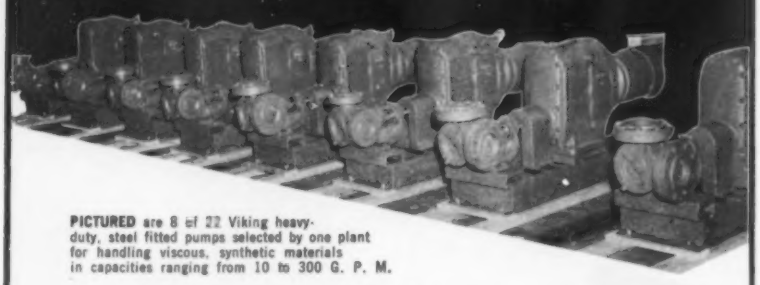

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DATA FILE

(Begins on page 228)

of hopper bottom cars. Applications are pictured. Link-Belt Co.

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Caster, Wheel Manual—Featured in 192-pp Manual 65 is comprehensive information on company's complete line of casters, wheels, glides, desk shoes and accessories. Illustrated with photos and dimensional drawings and diagrams of the various types of casters, and wheels for a variety of applications, manual contains tabulated engineering data. Darnell Corp.

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Industrial Casters—Catalog 159 contains 24-pp of illustrations, descriptions and specification data on swivel-plate and rigid-plate truck casters for industrial applications. Includes detailed information on spring-action casters, V-grooved casters, grease-sealed casters, scaffold casters, floor truck locks, industrial wheels, and others. Faultless Caster Corp.

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ROPE, SLINGS, CHAINS

Sling Chain Handbook—Illustrated Data Book 100, 32-pp, presents "how to do it" information on sling chains—from ordering to care, use and inspection. Contains diagrams, charts and tables on standard and special styles. Columbus McKinnon Corp.

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Sling Chains—Price List 512 contains 24 pp of detailed ordering data on sling chains and related materials handling items. Specifications are listed along with prices, tips on care and inspection, and table of wear. American Chain Div., American Chain and Cable Co., Inc.

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Preformed Wire Rope—Folder 4930 describes corrosion-resisting preformed wire rope of stainless steel and monel metal designed to meet variety of service requirements. Table shows breaking strength in pounds for various constructions and sizes. Macwhyte Wire Rope Co.

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CONSTRUCTION

Why Pre-Mixed Mortar—Use of Embeco pre-mixed mortar as a method of achieving tough, non-shrunk water-resistant joints and masonry repairs is detailed in Bulletin EPMM-2B. Illustrated instructions for use plus comparative compressive strength test results are provided. The Master Builders Co.

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Intrusion Piling—Described in 20-pp Special Report 102 is a cast-in place piling service using intrusion-prepacked concrete piles. Advantages of the cast-in-place piling are detailed, and typical construction projects are illustrated and described. Intrusion Prepakt Inc.

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Open Web Joists—Standard and long span open web steel joists are illustrated and described in this 38-pp catalog. Advantages of the steel joist construction are detailed, and sections are included on design calculation, properties and dimensions. American Bridge Div., United States Steel Corp.
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Underground Passageways—Described in 18-pp Bulletin LP-5960 are underpasses, tunnels, and conduits designed for safe pedestrian transport as well as industrial conveyance and service applications. Illustrates and describes sizes and shapes available and includes tables of data on liner plate. Armco Drainage & Metal Products, Inc.
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Screw Fastening of Aluminum—This 48-pp technical handbook covers various types of standard and special fasteners and fastening systems used to join aluminum assemblies. Supplemented with numerous illustrations and tables, it includes list of manufacturers of special screw fasteners and recommended hole sizes for screws. Reynolds Metals Co.
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Functional .Glass—Advantages of company's rolled, figured and wired glass for vertical sidewall and skylight glazing are detailed in Catalog 61-G, 20-pp. Describes types for commercial, institutional, industrial applications. Provides properties. Mississippi Glass Co.
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Reglazing Panels—Described in this product sheet is a translucent fiber glass panel designed for replacement of shattered and fractured panes of wire glass in top hinged continuous operated and fixed steel sash. Butler Mfg. Co.
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Insulated Wall Panels—Eight-pp Bulletin 60W describes insulated walls and metal panels for building construction. Includes detailed information on properties and construction, specifications, installation tips, color samples. Elwin G. Smith & Co., Inc.
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Any of these bulletins, catalogs and technical booklets can be yours without cost or obligation. Use the Reader Service Cards on page 224.

Corrosion Resisting Panels—Advantages of company's corrosion resisting panels for application in chemical environments are detailed in this 8-pp product bulletin. Table showing chemical resistance to various chemicals and table of physical properties included. Resolite Corp.
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Basic-Roofing Information—"What You Should Know About Your Roof" is a 40-pp clearly illustrated booklet which tells what makes a roof fail, how to recognize signs of roof deterioration, what to do to keep a roof in good condition. Discusses roofing practices. Johns-Manville Corp.
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Door and Frame Units—Illustrated and described in 20-pp Bulletin DHS-2060 are flush-design metal and wood doors, frames and hardware. Includes complete construction and specification data and a listing of standard hardware. Dusing and Hunt, Inc.
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Cold Storage Doors—Detailed information on company's power-operated and hand operated cold storage doors is presented in Catalog 260. Installation and specification data included. Clark Door Co., Inc.
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Cold Storage Doors—Advantages of company's Electroglide electric horizontal sliding doors for cooler and freezer operation are detailed in this 6-pp bulletin. Describing design and operation features, it also includes table of sizes, space requirement diagrams, and installation data. Jamison Cold Storage Door Co.
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Steel Floor Plate—Features and advantages of rolled steel floor plate are detailed in this Product Form 3184. Table of dimensional data is included, as well as illustrations of installations. Alan Wood Steel Co.
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Floor Surfacing—Described in product bulletin is a copolymerized floor surfacing claiming superior tensile, flexural, bond and compressive

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DATA FILE

(Begins on page 228)

strength. Detailed specifications and photos of typical applications are included. The Master Mechanics Co.
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Safety Floor Plate—Advantages of Multigrip floor plate designed for sure footing and positive traction under all conditions are detailed in 15-pp Bulletin ADUCO-17002-59. Tables list available sizes, thicknesses and weights, and show allowable uniform loads for various plate thicknesses and spans. U. S. Steel Corp.
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Safety Plate Uses—Practical ideas on truck repair and maintenance with safety plate designed for strength, protection and traction are presented in this 24-pp booklet. Applications illustrated include tailgates, bumpers, steps, protective panels, trim, walkways, and loading ramps. Inland Steel Co.
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Cut Nails—Illustrated and described in this 12-pp product bulletin are cut nails for a variety of general construction, flooring, furring, roofing, warehouse and other applications. Advantages of various nails for particular applications are described. Wheeling Corrugating Co.
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STORAGE SHOP EQUIPMENT

Flexible Steel Shelving—Advantages of Erectomatic steel shelving are illustrated and described in 8-pp Form 2451-D. Various types of shelving available are shown and dimensional data given. Columbia-Hallowell Div., Standard Pressed Steel Co.
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Storage Equipment—Reference Manual 487 contains 64-pp of descriptive data on a line of steel storage equipment, including shelving, bins, doors, slotted angle, drawer units, lockers, benches, grating, counters, and other items. Assembly details and dimensional data included. Equipto.
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Steel Equipment—Catalog 100 K contains 100 pp of detailed information on steel cabinets, folding chairs, work benches, tool stands, shelving, tool storage, lockers, coat racks, filing cabinets, revolving bins, others. Includes dimensions and specifications. Lyon Metal Products, Inc.
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WATER TREATING

Industrial Water Service—The importance of water to industry and advantages of an industrial water consulting service are detailed in this 22-pp bulletin. Specific examples of benefits offered typical users of the consulting system are given. Hall Laboratories, Inc.
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Cooling System Treatment—Bulletin C1 describes advantages of company's treatment for cooling tower systems with synergised polyphosphates. Details of the cooling system treatment are given. Nalco Chemical Company.
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Condensate Drainage Control—Publication 6025A describes a system of condensate drainage control for increasing production and improving quality with steam processing equipment. Includes standard unit specifications, dimensional data and diagrams. Cochrane Corp.
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For Corrosion Control—Pretreatment designed to promote rapid film formation as protection against cooling water corrosion is described in this water conditioning data sheet. Advantages of pretreatment for all-steel systems as well as for cooling water systems in general are detailed. Betz Laboratories, Inc.
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Steam System Protection—Application of organic amines for prevention of corrosion in steam and condensate return lines is detailed in this product bulletin. Explains how the Coravol treatment works and its advantages. Western Chemical Co.
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PROCESSING EQUIPMENT—

Industrial Equipment—Catalog A-660, 12-pp, discusses finishing systems—specifically—spray, dip or flow coatings, cleaning, pickling, rust-proofing, hydro-filter spray booths, dip and flow coaters, drying and bak-

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ing ovens, hydro-foam dust collectors and fog filters. The R. C. Mahon Co.
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For Processing, Heat Transfer—Description and specifications on laboratory and production blenders, vacuum tumble dryers, packaged pilot plants, process heat exchangers, a solids-processor, and general-purpose solids-flo valve are presented in 20-pp Bulletin 16-P. Using tables and diagrams, bulletin lists standard dimensions. The Patterson-Kelley Co., Inc.
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For Heat Processing—Finishing systems, ovens and furnaces used in heat processing are featured in this 8-pp bulletin. Illustrations of various installations are included, along with descriptive and dimensional data. Despatch Oven Co.
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BOILERS, BURNERS

Automatic Boilers—How Continental automatic boilers are designed to offer reliable and economical operation is discussed in Form BE 400. Stresses advantage of two-pass design; describes burners, controls. Boilers covered include 20 to 600 hp steam boilers, hot water and HWT boilers, for oil-, gas, or combination fuel. Continental Boiler Div., Boiler Engineering & Supply Co., Inc.
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Automatic Boilers—Powermaster Model 3 packaged automatic boilers are described and illustrated in 12-pp Bulletin 1260. Boiler types, including gas, oil and combination gas-oil models, a specially-designed hot water boiler, and steam atomizing principle for use with No. 6 oil are included. Orr & Sembower, Inc.
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Packaged Boilers—Featured in 8-pp Bulletin AD 167 is a line of packaged boilers and high temperature equipment for heating and process loads. Specifications, rating and dimension tables included. Cleaver-Brooks Co.
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Steam Generators—Advantages of company's steam generators designed to adjust to actual production needs are detailed in this 6-pp Product Bulletin C-731. Schematic diagram showing operating details is included. Clayton Mfg. Co.
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Industrial Burners—Advantages of company's industrial burners are detailed in illustrated Bulletin 3. A number of different types for a variety of applications are described. Industrial Combustion, Inc.
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HEATERS, HEATING

Electric Comfort Heating—Six pp Bulletin F-975C illustrates Chromalox electric comfort heaters, including convection, forced-air and radiant heaters that may be surface mounted, built into the wall or installed in a duct system. Wall mounted thermostats, both line and low voltage models, shown. Edwin L. Wiegand Co.
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Horizontal Unit Heaters—Compact propeller-type unit heaters featuring company's Steelfin coils for steam or hot water heating. Ideal for commercial, institutional, and industrial space heating. Eleven sizes with air capacities from 400 cfm to 5300 cfm and heating capacities from 31 to 300 mbh are described in Bulletins 552 and 553. The New York Blower Co.
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Unit Heaters—Detailed information on unit heaters for steam and hot water systems is presented in 16-pp Catalog 159. Includes steam performance data, conversion factors, hot water performance data, dimensions, selection data. Modine Mfg. Co.
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FANS, BLOWERS

Space Saving Fans—Features and advantages of an airfoil centrifugal fan which boasts the high efficiency characteristics of a centrifugal fan yet requires less than half the installed space are detailed in 14-pp Catalog 1125. Illustrated with photos, construction and installation diagrams, it contains performance curves and selection tables. Sturtevant Div., Westinghouse Electric Corp.
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Propeller Fans—Detailed information on a line of propeller fans and

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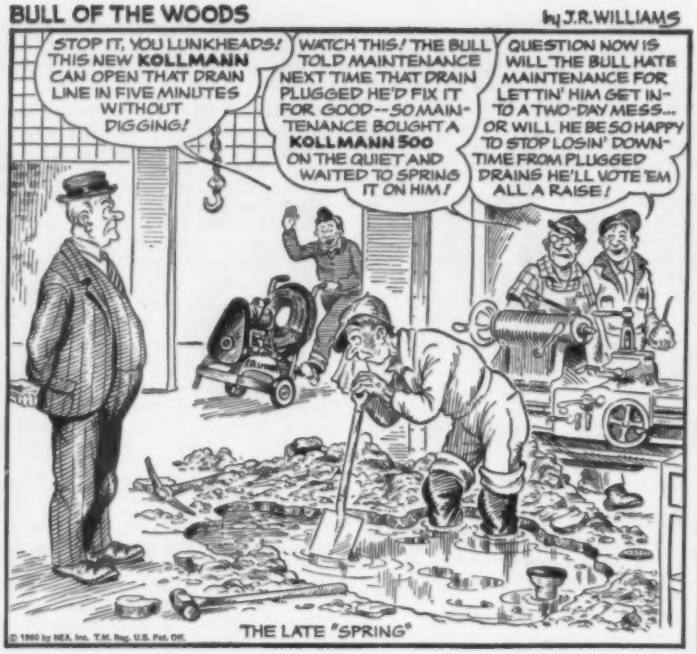
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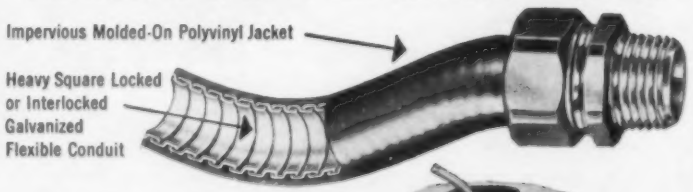

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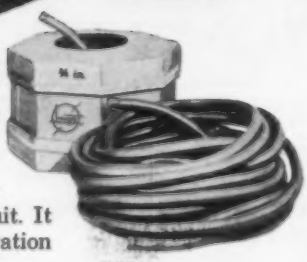

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DATA FILE

(Begins on page 228)

accessories is presented in 20-pp Bulletin A-109E. Dimensional tables, ratings for single,two-propeller and multiblade fans are included. Hartzell Propeller Fan Co.
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Roof Ventilators—Solid plastic roof ventilators for removing corrosive fumes are described in Engineering Data Sheet E-7801. Specifications and dimensional data are included. Heil Process Equipment Corp.
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Air Engineering—Builetin E-57 is a 24-pp air engineering data file covering engineering and test facilities for propeller fans, specifications, construction, maintenance, and installation. Tables for estimating air-handling requirements provided. Aerovent Fan Co., Inc.
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Make-up Air Solutions—Bulletin EN-5911 explains how make-up air properly introduced and tempered overcomes negative air pressure and eliminates problems arising when fans draw fumes, smoke or odors. Outlines design of a make-up air system and tells how to select correct equipment. Also includes schematic diagram and instructions for wiring control arrangement. Reznor Mfg. Co.
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Power Roof, Wall Exhausters—Bulletin 58-B describes Series CR (centrifugal) and Series AR (axial) direct drive power roof exhausters and the Series CW (centrifugal) wall exhauster. Capacities range from 170 to 5,750 cfm. Each unit and model has a U-spring suspension to eliminate vibration noise. Performance and dimensional data, electrical characteristics, and curb cap mounting diagrams are included. Jenn-Air Products Co., Inc.
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Belt-Driven Fans—Detailed selection data on belt-driven Util-A-Sets with backward blade and forward curved wheel is presented in 20-pp Bulletin 3401. Pertinent engineering data includes capacity tables, dimensional drawings, sample fan specifications

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Working Pressure: to 180 psig @ 350° F

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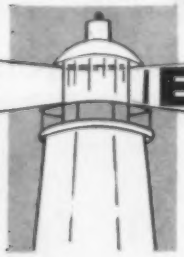

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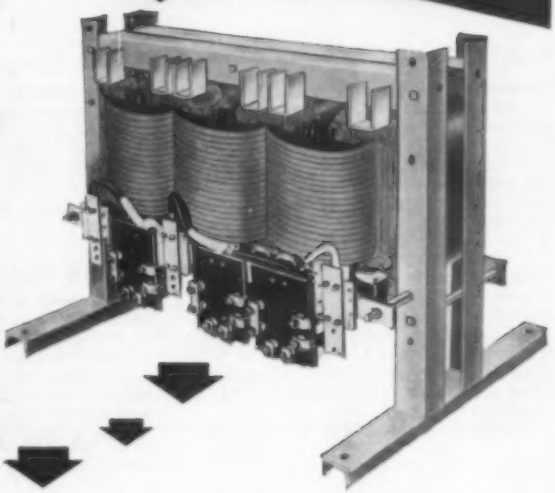

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DATA FILE

(Begins on page 228)

and other data useful in engineering ventilation installations. Ilg Electric Ventilating Co.

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Turbine Type Blowers—Bulletin 142C describes company's turbine type blowers for sewage treatment and other agitation applications in chemical, food processing and other fields. Includes installation data, typical job specifications. The Spencer Turbine Co.

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PLASTICS

Industrial Plastics—This 12-pp booklet contains property and application data on mill shapes of nylon, TFE fluorocarbons, polycarbonates, chlorinated polyethers and cross-linked polystyrene. Data on nylon pressure hose and tubing also presented. The Polymer Corp. of Penn.

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Fire-Resistant Resin—Structural panels, skylight louvers, chemical duct-work and other products made of Hetron, permanently flame-resistant polyester resin are covered in this illustrated bulletin. Table lists characteristics. Durez Plastics Div., Hooker Chemical Corp.

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FILTERING

Improved Filters—Bulletin GEO-507 describes Fulflo filters for compressed air and other gases, covering single tube models for operating pressures from below 125 psi to 4000 psi, and flow rates to 800 scfm, also multitube models for high flow rates. Includes technical information and charts on flow characteristics, dimensions. Commercial Filters Corp.

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Filters for Industry—Illustrated and described in this product bulletin are filters for a variety of applications in industry. Among those covered are liquid filters, intake filters, pipe line filters, dry and viscous panel filters, precipitators, Electro-Staynew mist collector, and a dual action filter. The Dollinger Corp.

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Fabric Filter—Engineering and design features of fabric filters for industrial dust collection are detailed in Bulletin 150. Filter capacities and dimensional data included. John Wood Co.

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OTHER EQUIPMENT

Compressed Air Products—Color-coded for easy product identification, 24-pp Catalog 158 contains comprehensive information on company's compressed air products, including filters, regulators, lubricators, drains and accessories. Wilkerson Corp.

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Chain Link Fence—Catalog F-915, 64-pp, contains illustrated information on company's line of chain link fences of aluminum or steel for a variety of industrial, commercial and other applications. Detailed specifications and dimensional data are included, also photos of installations. The Colorado Fuel and Iron Corp.

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Product Guide—Booklet 25B6057, 22 pp, shows the wide range of products manufactured by the company. It contains an alphabetical listing of the products, with reference to engineering literature available. Allis-Chalmers Mfg. Co.

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Absorption Cold Generator—Featured in 20-pp Catalog DS-435 is a completely hermetic, packaged absorption refrigeration machine which uses low pressure steam to produce chilled water for air conditioning and process applications. Design and operation diagrams are included, as well as selection data. The Trane Co.

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High-Silicon Anodes—Advantages of high silicon cast iron anodes for cathodic protection of steel water tanks are detailed in Publication TP-113-E-1. Various types of anodes for cathodic protection are described. Electro Rust-Proofing Corp.

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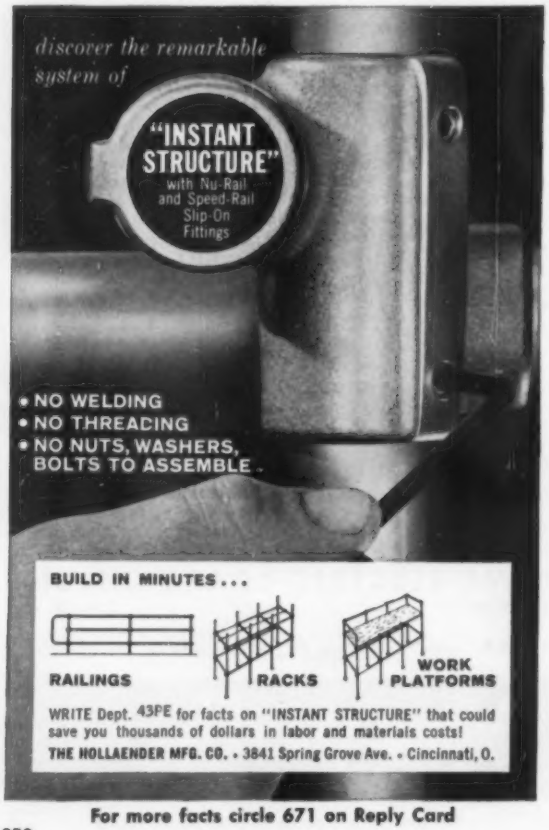
Special Equipment—Featured in Bulletin 7-A is a line of custom-engineered air and hydraulic operated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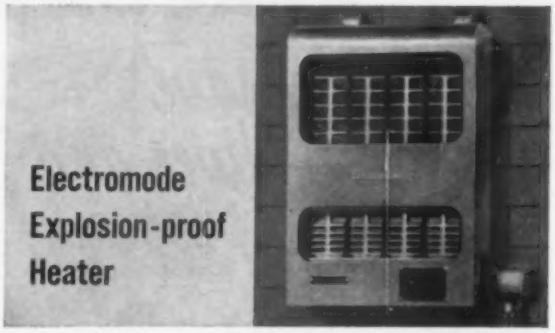

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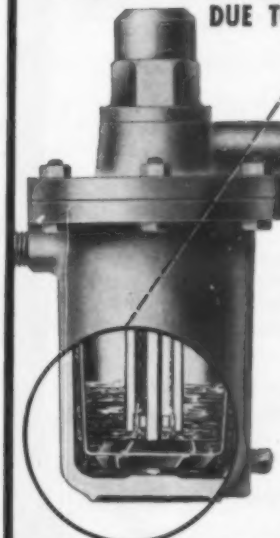

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DATA FILE

(Begins on page 228)

machines for a variety of industrial operations. Details of design and operation are described. Logansport Machine Co., Inc.
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Preheating Combustion Air—This well-illustrated 36-pp booklet explains fuel savings and increased performance made possible by using waste heat in flue gases to preheat incoming combustion air. Also covers increased boiler output, ability to use lower grade fuels effectively. Air Preheater Corp.
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Molybdenum Products—Detailed information on sizes, forms, conditions of use, tolerances, weights and methods of identification of company's molybdenum products is presented in this 24-pp bulletin. Properties of molybdenum and molybdenum-base alloys are given, and specific applications for products ranging from grids in electron tubes, grinding quills, and thermocouples, covered. Climax Molybdenum Co.
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All-Purpose Hose—Illustrated and described in Bulletin A-5157K is an all-purpose hose designed for air, oil, gasoline, chemicals and water applications. Advantages and economies of this hose are detailed. Goodyear Tire & Rubber Co.
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Double-Flow Aquatower—Bulletin DFA15-60 describes company's double-flow Aquatower designed to bridge the gap between standard double-flow Aquatowers and unlimited capacity industrial cooling towers. Specifications and engineering data included. The Marley Co.
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On Blast Cleaning—Illustrated and described in 24-pp Bulletin 1230 are blast cleaning and finishing methods and equipment. Features blast cleaning barrels, tables, descaling machines, as well as dust control equipment, abrasives and accessories. Pangborn Corp.
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Glass-Protected Stacks—Features and advantages of glass-protected smokestacks are described in Bulletin SS-210. Includes comparative maintenance figures, photos of typical installations, tables of weights, basic stack sections, protective glass coating, operating temperature ranges, assembly. A. O. Smith Corp.
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Single Shaft Turbines—Features of single shaft gas turbines designed for mechanical and generator drive are outlined in 6-pp Bulletin 186. Includes cutaway cross-section showing component details, as well as table of dimensions and specifications, materials of construction. Clark Bros. Co., Div. Dresser Industries, Inc.
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Urethane Foams—Properties and applications of urethane foams are illustrated and described in this 28-pp product bulletin. Along with chemical and physical properties, bulletin covers applications in encapsulating electronic components, packaging, insulation, architectural curtain walls and panels, and as safety, convenience and comfort padding. Mobay Chemical Co.
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Hydraulic Press Brakes—Illustrated and described in 8-pp Form 2024D are hydraulic press brakes designed to perform a variety of operations with maximum safety. Describes features and advantages and includes clearance dimensions and specifications. The Cleveland Crane & Engineering Co.
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Sectional Heat Exchanger—Bulletin 132 describes a self-contained sectional heat exchanger independent of any considerable water supply. Cutaway diagram illustrates and explains functions. Niagara Blower Co.
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Emulsifying Cutting Oil—Advantages of company's emulsifying cutting oil are fully detailed in Form A-2778. Applications of the cutting oil in the metalworking industry are described. Sun Oil Co.
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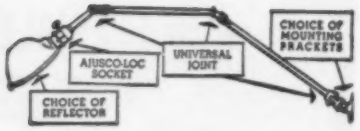

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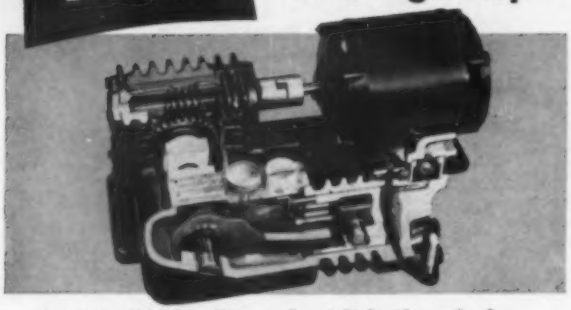

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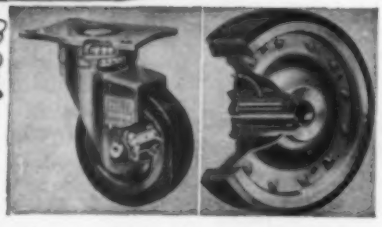

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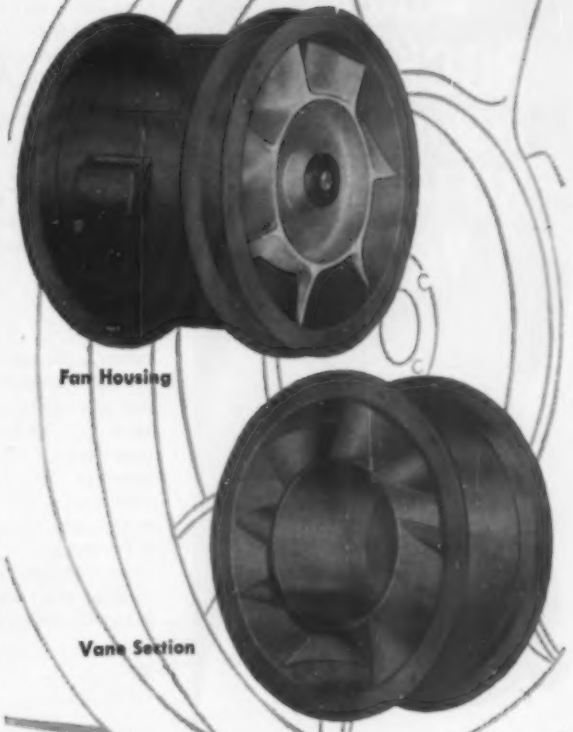

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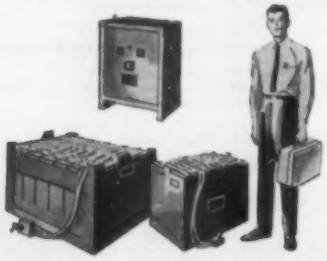
EXIDE POWER PACKAGE

Exide Industrial Marketing Division, The Electric Storage Battery Company, Philadelphia 20, Pa. (ESB)

HOW MUCH EXTRA BATTERY LIFE CAN YOU GET?

You may be getting good battery life now. But the fact is that almost every battery can give better life if certain rather simple conditions are met.

Helping you to get maximum life, and therefore greatest economy, from your batteries is part of the Exide Power Package. The first step is selecting the particular type and capacity battery to fit the job. Your Exide man will recommend a battery capable of providing adequate power without the need for deep discharging. Knowing how to do this accurately is part of his special skill.



The Exide Power Package: Broadest choice of all types of batteries and chargers to meet all requirements, plus factory-quality service for both batteries and chargers.

To meet your particular requirements, he can draw from the broadest line of batteries for industrial truck power, including Exide-Ironclad with tubular positive plate construction; Exide-Powerclad premium pasted plate; and the improved Exide nickel-iron-alkaline (invented by Thomas A. Edison).

Second, it is important that the charger be able to recharge the battery completely within the allotted time, and at the desired rate. If a battery isn't adequately charged, it loses efficiency and its power output is reduced. At the same time, you must guard against overcharging too. Play safe. Ask your Exide man to recommend the right size and type Exide charger when you buy your Exide battery.

Third, make sure your batteries receive good upkeep. This involves more than just routine cleaning and watering. It means periodic inspection and checking by battery maintenance engineers. Exide offers this service at a reasonable fee. Exide service men will help you set up good battery maintenance schedules. They will diagnose problems which might develop—show you whether the cause is in the truck, the charger, the application, or the maintenance. And they will take care of any repairs or adjustments to batteries or chargers which might be called for. You get complete battery and charger service from one source, fast, thorough, dependable.

The combined effects of these three basic parts of the Exide Power Package mean not only longer battery life, but greater battery economy year after year. Find out exactly how you can benefit. Write Exide Industrial Marketing Division, The Electric Storage Battery Company, Philadelphia 20, Pa.

Simplified electricity bulletin. Do you want to know how storage batteries work and what goes on as they charge and discharge? Send for this detailed bulletin. It's yours free. Also contains tips on how to keep batteries in top operating condition.

Exide®

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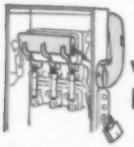
ONLY VISIBLE BLADES GIVE YOU SAFETY YOU CAN SEE!

• The men who pull the switches will tell you what can happen when a switch, *believed* to be open —*isn't*. A lot of things can happen—and every one of them is bad. Personnel safety is in jeopardy. Motors can single-phase. Machinery and work can be damaged. Down-time can skyrocket.

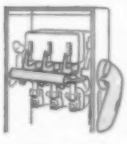
Doesn't it make sense to insist on Visible Blade construction which gives you a road block against any of those possibilities? Doesn't it make equally good sense to insist on the safety switch which gives you that construction—plus a lot of other performance advantages? Evidently it does, because *Square D switches have never been out of first place in more than 50 years!*

They cost no more... why settle for less?

Extra Safety with Square D's Handle Design



WHEN IT'S UP IT'S ON!



WHEN IT'S DOWN IT'S OFF!

Handle is integral part of switch, not cover. When door is opened, handle remains attached to switch. Eliminates hazard of false handle indication or defeat of padlock provision. When it's padlocked, it's locked!

SQUARE D COMPANY

wherever electricity is distributed and controlled

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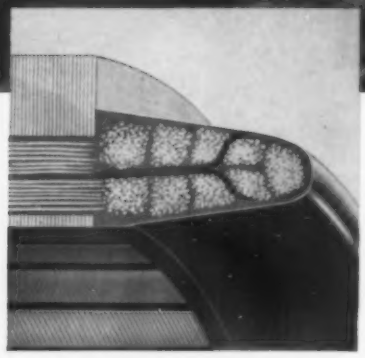
U.S. EVERSEAL

Protects against heat... water... chemicals

U.S. EVERSEAL resin-encapsulated windings are completely protected against severe environments: Heat, cold, vibration, acids, gases (even in high concentrations), lye, potash, ammonia, caustic soda, salt, abrasives, carbon black, graphic dusts, and many other conditions that formerly meant short motor life. In many applications, EVERSEAL provides the protection of totally-enclosed motors while still maintaining the higher service factor of open motors. U.S. Motors developed a way of molding without excessive thickness. Fully molded U.S. EVERSEAL *complete encapsulation* is available on any U.S. motor, ½ h.p. to 125 h.p. On higher horsepower motors, U.S. offers EVERSEAL silicone rubber insulation. *Request free* EVERSEAL *literature.*



Note complete coverage and protection provided by molded end-turn construction.

U.S. ELECTRICAL MOTORS INC.

P.O. Box 2058 • Los Angeles 54, California or Milford, Connecticut

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